1993-1995 EcMP Vegetation Report

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PTI
ENVIRONMENTAL SERVICES
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Site Vegetation Report

Terrestrial Vegetation Survey (1993–1995) for the Rocky Flats Environmental Technology Site

Prepared for

Kaiser-Hill Company, LLC
Rocky Flats Environmental Technology Site
Golden, Colorado 80402-0464

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ACRONYMS AND ABBREVIATIONS

CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CNHP	Colorado Natural Heritage Program
DOE	U.S. Department of Energy
EcMP	Ecological Monitoring Program
OU	Operable unit
RCRA	Resource Conservation and Recovery Act
Site	Rocky Flats Environmental Technology Site

INTRODUCTION

The Ecological Monitoring Program (EcMP) was designed to investigate the long-term ecological trends in terrestrial and aquatic ecosystems at the U.S. Department of Energy's (DOE's) Rocky Flats Environmental Technology Site (Site) (DOE 1993). Field sampling was conducted during 1993, 1994, and 1995, until the program was terminated in late 1995. This report presents the terrestrial vegetation data that were gathered by the EcMP.

The Site is located on the Colorado Piedmont, east of the Front Range, between Boulder and Golden, approximately 25 km (16 miles) northwest of Denver. The topography and proximity of the Site to the mountain front result in an interesting mixture of prairie and mountain plant species. The Site is one of the few large, relatively undisturbed areas of its kind that remains along the Colorado Piedmont. Until 1989, the primary mission of the Site was the production of nuclear weapons components (DOE 1993). After production ceased, Site personnel shifted their focus to cleanup and closure.

Prior to the EcMP program, ecological studies at the Site included a botanical inventory done in the early 1970s (Weber 1974) and a plant community/ordination study, which produced an early vegetation map of the Site (Clark et al. 1980). Colorado State University conducted a variety of radionuclide studies on various ecosystem components (Jarvis 1991; Whicker et al. 1990). During 1991, a baseline wildlife and vegetation study was done to provide ecological information on the plant, animal, and aquatic communities at the Site (DOE 1992). Additionally, ecological data were gathered for specific Operable Units (OUs) to comply with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA).

Since the termination of the EcMP program, monitoring of plant communities at the Site has continued based on a re-evaluation of data quality objectives. Specifically, vegetation monitoring objectives have been modified to address the DOE's goal of proactively managing land use at the Site to protect ecological resources. Both qualitative and quantitative monitoring of identified high-value vegetation communities, and of the results of weed control and controlled burns, are currently underway (K-H 1997a). In addition, the tall upland shrubland community (an unusual shrubland community found at the Site, which had not been examined previously) was inventoried and characterized in 1996 (K-H-1997b). The results of ongoing monitoring efforts will be presented in future Site vegetation reports.

EcMP TERRESTRIAL VEGETATION STUDY OBJECTIVES

As stated in the EcMP program plan (DOE 1993), the objectives of the terrestrial vegetation module were to "characterize the composition, distribution, and production of the major plant communities at the Site." Information gathered by the program was to be used to examine patterns and natural spatial and temporal variations within and between plant communities at the Site and in comparison to surrounding bioregions. It was also to provide information to document temporal and spatial changes in the plant communities that may have been related to past land use management practices or disturbances.

The program was not designed as a comprehensive vegetation inventory and was not intended to sample all the plant communities at the Site. Instead, it subjectively focused on those communities identified in the baseline study (DOE 1992) as spatially important or representative (xeric mixed grassland and mesic mixed grassland), biologically important or unique (riparian woodland), and disturbed (reclaimed grassland).

PURPOSE

The purpose of this report is to summarize and interpret the species richness, cover, and biomass data collected for the EcMP from the xeric mixed grassland, mesic mixed grassland, riparian woodland, and reclaimed grassland communities during the field seasons of 1993, 1994, and 1995. Plant nutrient data were collected only in 1993. These data are described in the 1994 EcMP annual report (DOE 1994), and are not discussed in this report.

QUESTIONS

A number of questions relating to the vegetation were proposed for investigation in the EcMP program plan (DOE 1993). Some of these questions were addressed in the 1994 and 1995 EcMP annual reports (DOE 1994, 1995a). Others were not addressed because insufficient data were available at the time the program was terminated. Therefore, the following questions from the 1994 and 1995 EcMP annual reports are addressed in summarizing the three years of EcMP terrestrial vegetation data:

- How does species richness vary among the plant communities sampled?
- How do basal cover and plant foliar cover vary among the plant communities sampled?
- How does plant productivity (biomass) vary among the plant communities sampled?

In addition, the following questions are addressed in this report:

- Are any trends or changes evident in the data over the three-year period?
- Do the data reveal any special concerns or issues with regard to specific plant communities?

METHODS

EcMP TERRESTRIAL STUDY SITES

The plant communities sampled by the EcMP were organized along a soil moisture (hydrologic) gradient ranging from xeric (dry) to mesic (moderate moisture) to hydric (wet). This approach followed the plant community classification that was outlined in the baseline study (DOE 1992), which identified xeric (xeric mixed grassland), mesic (mesic mixed grassland), and hydric (riparian community) communities at the Site. Twelve sampling sites (approximately 2 hectares each) were selected, three for each hydrologic gradient classification. One site for each hydrologic classification was placed in each of the major watersheds (Rock Creek, Walnut Creek, and Smart Ditch) at the Site (Figure 1). Woman Creek was not used as a watershed, because it was considered a "contaminated," or affected, area and the EcMP was designed to focus on "unaffected" areas that would not be disturbed by remediation activities, which (at that time) were projected to start soon. In addition, three sites were also located in the reclaimed grassland (an old agricultural area), which prior to cultivation, was probably mesic mixed grassland. All three of the reclaimed sites were located in one watershed (Smart Ditch), because no other areas at the Site had been tilled and subsequently revegetated. The sample site codes, community type, and watershed designations for the 12 sites are shown in Table 1 (all tables are found following the References). The locations of the EcMP sampling sites are shown in Figure 1.

METHODS OVERVIEW

Within each site, five 50-m transects were randomly located and permanently marked. The types of vegetation sampling conducted each year (1993–1995) at the EcMP sites are shown in Table 2.

A general description of the species richness, cover, and biomass sampling follows. For greater detail, see the *Ecological Monitoring Program, Final Program Plan* (DOE 1993) and the *Environmental Management Operating Procedures Manual, Volume V, Ecology, 5-51200-OPS-EE* (DOE 1995b). The plant nutrient analyses are not described in this report, because the resulting data are not included (see DOE 1994).

SPECIES RICHNESS (BELT TRANSECTS)

Species richness was determined in a 2-m-wide belt centered along the length of the 50-m transect. Every plant species within the 100-m^2 area was recorded and its phenological

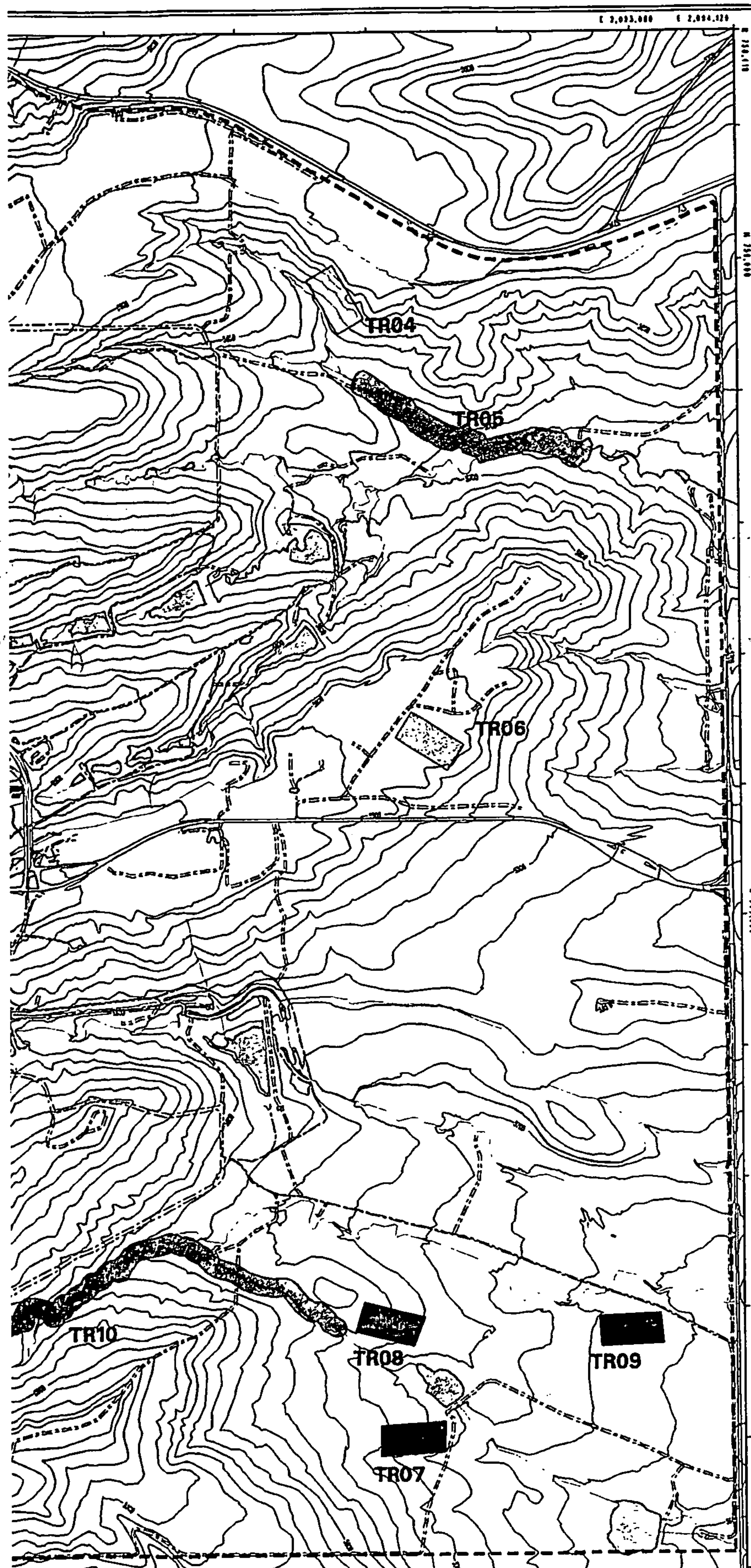

Figure 1.
EcMP Terrestrial Sites (1993-1995)

EXPLANATION

Community Types

- Mesic Mixed Grassland
- Xeric Mixed Grassland
- Reclaimed Grassland
- Riparian Woodland

Standard Map Features

- Buildings or other structures
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences
- Contours (20' Intervals)
- Rocky Flats boundary
- Paved roads
- Dirt roads

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. - 1991.
Hydrology provided by USGS - (date unknown)

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N

Scale = 1 : 20450
1 inch represents approximately 1704 feet

500 0 1000 2000 ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

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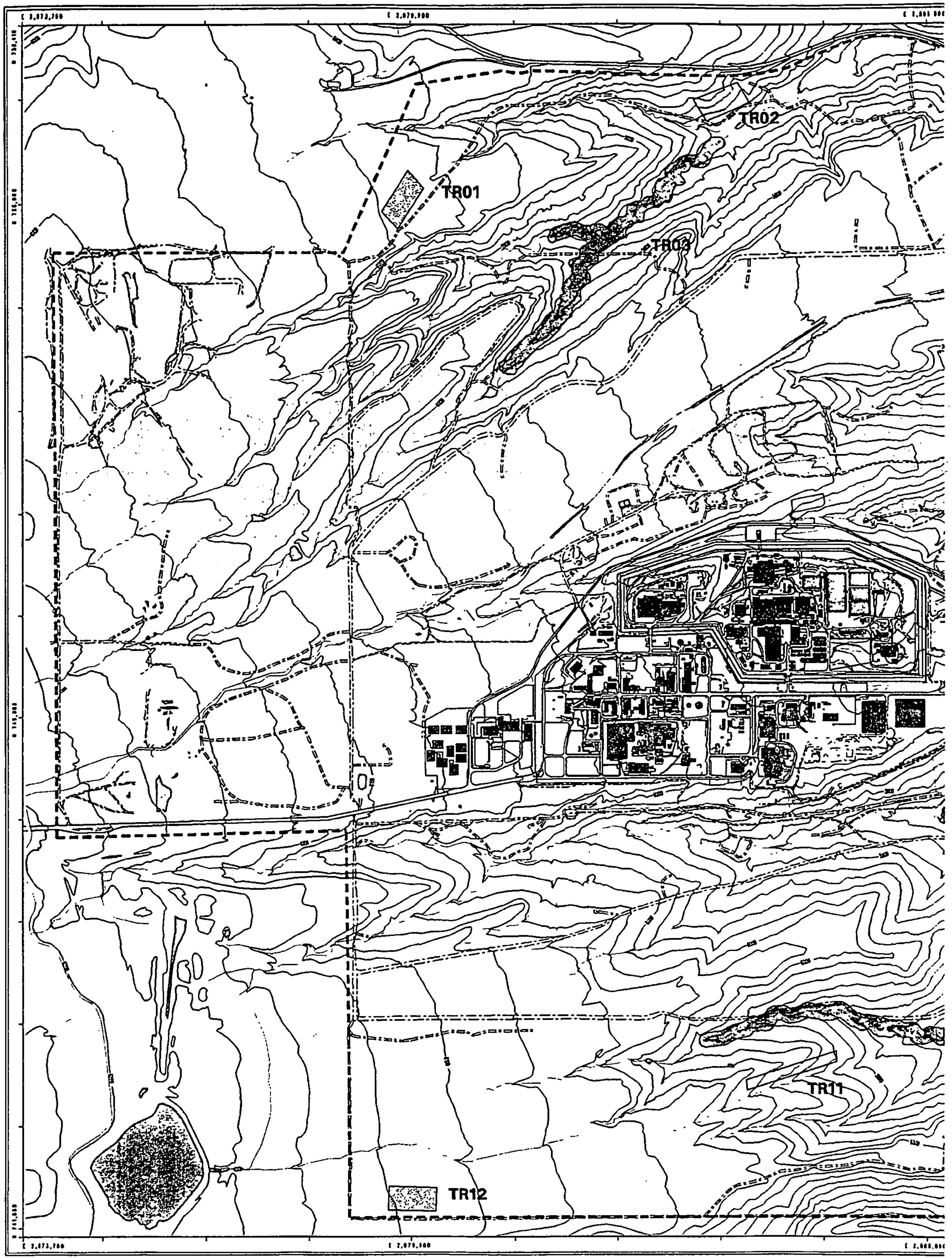
MAP ID: x7707 March 19, 1997



TR01
TR02
TR03
TR11
TR12

state noted. In addition, the densities of the woody plant stems and cactus species were recorded. Species richness was measured both in the spring and late summer to provide a more complete species list for the entire growing season. Belt transects were sampled at all 12 sites.

Species richness data were summarized by generating a species list for each site and each community. In addition, other species richness variables were calculated from the species lists.

COVER (POINT-INTERCEPT TRANSECTS)

Basal cover and foliar cover estimates were made using a point-intercept method along the 50-m transects in late summer (fall) sampling. A 2-m-long rod (0.25-inch diameter) was dropped vertically at 50-cm increments along the transect to record a total of 100 intercept points. Two types of hits were recorded. Basal cover hits were recorded based on what was hit by the rod at the ground surface. Hits could be vegetation (live plants), litter (fallen dead material), rock (pebbles and cobbles that were greater than the rod diameter), bare ground, or water—in that order of priority—based on the protection from erosion provided by each type of cover. Basal vegetation hits were recorded only if the rod was touching the stem or crown of the plant where it entered the ground. Foliar vegetation hits were recorded in three categories defined by height and growth form. The topmost hit of each growth form was recorded. The growth forms measured were herbaceous, woody <2 m high, and woody >2 m high. Point-intercept sampling was conducted at all 12 sites.

Basal cover data were reported as total percent cover of vegetation, litter, rock, bare ground, and water. Foliar cover data were reported as frequency, relative cover, and absolute cover for each species encountered. Frequency was defined as the percent of transects along which a species occurred, out of the possible five sampled at a specific site. Absolute cover was the percentage of the number of hits on a species out of the total number of hits possible at a site (500). Relative cover was the number of hits on a species, relative to the total number of vegetative hits per site (i.e., the percent of vegetative cover the species represented).

BIOMASS (PRODUCTION PLOT)

Biomass sampling was conducted during late summer at the nine grassland sites only. No biomass sampling was conducted in the riparian community because of the difficulty and destructive nature of sampling woody vegetation for biomass. Five randomly located 0.25-m^2 quadrats were placed between 1–5 m outside the 2-m-wide belt transect, on either side of each transect. A total of 25 quadrats (five per transect) were sampled at each site. Biomass was determined by clipping all the non-woody vegetation within the quadrat. In 1993, clipped material was divided into three classes: current year live, current year dead, and previous year dead. Current year live material was sorted by species, while the current year dead and previous year dead were not. In 1994, clipped material was divided into only two classes: current year live and current year dead. Both classes in 1994 were sorted by species. During both 1993 and 1994, litter was also collected from the quadrats. Oven dry weights were determined for each sample. Biomass data for 1993 were reported as total biomass (g/m^2). No individual species biomass calculations were possible because of the way the data were gathered in 1993. Biomass data in 1994 were reported as total biomass (g/m^2) and by individual species.

DATA QUALITY

All data were verified and validated prior to data analysis. However, some concerns are associated with specific data sets, and these concerns must be accounted for in interpreting the results. Appendix B contains a list of the data sets available from the EcMP terrestrial vegetation sampling and any concerns related to them.

DATA ANALYSIS AND SUMMARIZATION

The 1995 EcMP annual report (DOE 1995a) discussed much of the vegetation data that had been gathered in 1993 and 1994. That report described the dominant species found in each community and statistically compared differences between sites and communities for a variety of species richness, cover, and biomass variables. Comparisons were also made between Site data and data from other locations, to place the Site into more of a regional context. In addition, results of an ordination and classification study based on 1994 transect species presence/absence data revealed how the transects, sites, and communities sampled under the EcMP were related to each other. Rather than restate the observations made in that report (DOE 1995a), only differences that resulted from the addition of the 1995 data, or new findings based on comparisons of data from all three years, will be discussed here. Additional information from more recent studies (e.g., 1996 vegetation map methodology and classification; Appendix A) are discussed here, as well. Belt transect, point-intercept transect, and production plot vegetation data for 1993–1995 (from the EcMP sites shown in Figure 1) are presented by data and community types, to focus on issues related to each community. Variations among the sites within communities are also discussed where appropriate. Some suggestions are made for the use and application of these data for land management decision making.

For the analyses presented, the following "rules" were applied. Taxa identified only to the family or genus level were included only in the calculations of species richness variables when no other species were verified from the same family or genus at the same site or community. Because genera and families generally are not wholly native or non-native, when determining the percent of native species at a site or community, taxa identified only to that level were left out of the determinations altogether. When counting the numbers of annuals, biennials, and perennials, plants identified to the genus or family level were included in the counts only if: 1) the species met the criteria mentioned above for genera and family-level identifications, and 2) the species within that genus or family that are known to occur at the Site could be definitively placed in one category or another. In cases where a species could be an annual, biennial, perennial, or any combination of these (as listed in plant manuals), the following rules were applied. Plants were counted as annuals only when considered an annual or annual/biennial. Plants were counted as perennial whenever they were considered perennial, even if they could also occur as annuals or biennials. The biennial category was used only when a species was listed solely as a biennial. As used in the results and discussion, totals for site calculations are based on a mean value of the five transects (n=5). If a mean is given for the community total, it is based on the means for the three sites that represent that community (e.g., TR01, TR06, and TR12 = xeric community). In other cases, however, the community value is based on a combination of all three sites for a given community, to determine the total value for the variable being considered for that community (i.e., total species richness for the xeric community = 133 species, compared to the xeric community mean species richness = 89 [1994 data, Table 3]). If a mean value is given in the text, it will be designated as a mean value. If no such designation is given, it is a combined value.

No statistical analyses were done on the three years of EcMP data for this report. Statistical analyses, ordinations, and classifications were conducted on the 1994 data sets (DOE 1995a) to examine differences between communities and sites. Because differences between years appeared inconsequential, these analyses were not repeated. Some attempts were made to examine potential trends in the three years of data, although trend analysis generally requires longer-term data sets than were available from the EcMP data. With only three years of data, the best option was to examine the variability inherent in the communities resulting from annual environmental differences and/or annual sampling error.

RESULTS AND DISCUSSION

SPECIES RICHNESS

A total of 332 species of vascular plants were recorded at all the EcMP sites sampled during the three-year period (Table 3). The species recorded at each EcMP site each year are listed in Table 3. The riparian woodland community had the highest species richness each year, with site TR03 consistently containing the most species of any site (Tables 3 and 4). The reclaimed grassland had the lowest species richness; site TR09 consistently showed the lowest number of species (Tables 3 and 4). In the native communities (reclaimed grassland excluded), species richness increased along the hydrologic gradient from dry to wet (Tables 3 and 4).

The data appear to indicate an annual increase in species richness at nearly all sites and communities over the three years (Tables 3 and 4). However, this increase is best explained by different personnel sampling the transects and their increased familiarity with Site flora over time. Therefore, this trend should not be misinterpreted as a significant ecological event. Additionally, 1993 species richness sampling started in July, and the totals for 1993 lack many of the spring ephemeral species.

The community with the highest percentage of native species was the xeric mixed grassland (three year mean = 83 percent), followed by the mesic mixed grassland (three year mean = 80 percent), riparian woodland (three year mean = 73 percent), and reclaimed grassland communities (three year mean = 62 percent; Table 4). The site with the highest percentage of native species over the three years was TR01, a xeric mixed grassland site, which had a three-year mean of 86 percent (Table 4). The lowest percentage of native species for a site was found at TR09, a reclaimed grassland site, which had a three-year mean of only 29 percent (Table 4). The variation in percentage of native species among sites and communities is probably attributable largely to past land use practices and isolation from disturbance.

Perennial species were predominant at all sites and communities (Table 4). Tree and vine growth forms were recorded only in the riparian community, and although the highest number of shrub species was recorded in the riparian community, this life form occurred in all other communities as well (Table 4). The numbers of cacti species were highest in the native grasslands (xeric mixed grassland and mesic mixed grassland) and lowest in the reclaimed grassland (Table 4). Forb (dicot) species outnumbered graminoid (monocot) species at all sites and communities by a factor of two to five times, depending on the site or community (Table 4).

The same ten species were recorded at least once at every EcMP site during the three-year period (Table 3). These species were hairy goldenaster (*Chrysopsis villosa*), prickly lettuce (*Lactuca serriola*), false salsify (*Scorzonera laciniata*), goat's beard (*Tragopogon dubius*), field alyssum (*Alyssum minus*), small-seeded false flax (*Camelina microcarpa*), pinnate tansymustard (*Descurania pinnata*), western wheatgrass (*Agropyron smithii*), Japanese brome (*Bromus japonicus*), and Kentucky bluegrass (*Poa pratensis*). Of these ten species, only two were native; hairy goldenaster and western wheatgrass. The other eight were adventive, non-native species with a tolerance for a wide range of conditions.

A number of species were found in only one of the four sampled communities. The community with the fewest species "restricted" to it was the reclaimed grassland, which had only four species that were not recorded in any other community (Table 5). The mesic mixed grassland and xeric mixed grassland had 16 and 23 species restricted to them, respectively (Table 5). The riparian community contained the highest number of species that were recorded only there (113; Table 5). Of the restricted species, 91 percent were native species in the xeric mixed grassland, 88 percent were native in the mesic mixed grassland, 82 percent in the riparian woodland, and 50 percent in the reclaimed grassland (Table 5).

WOODY STEM AND CACTUS DENSITIES

The highest cactus densities were found in the xeric mixed grassland (three-year mean = 0.77 cacti/m^2), and the lowest were found in the reclaimed grassland (three-year mean = 0.01 cacti/m^2). TR12, a xeric mixed grassland site, had the highest three-year mean cactus density (1.08 cacti/m^2) of all sites, while TR05, a riparian woodland site, had no cactus recorded during the three years (Table 6). Woody stem densities were highest in the riparian woodland community (three-year mean = 7.57 woody stems/m^2) and lowest in the reclaimed grassland (three-year mean = 0.003 woody stems/m^2). TR10, a riparian woodland site, had the highest woody stem density of all sites, with a three-year mean of 11.6 woody stems/m^2 (Table 6). This was approximately twice the density found at the other riparian woodland sites, TR03 and TR05 (Table 6). Two sites—TR12, a xeric mixed grassland site, and TR09, a reclaimed grassland site—had no woody stems recorded during the three-year period (Table 6).

COVER

Basal cover was measured to indicate the degree to which the ground surface is protected from wind and water erosion. Basal cover represents the amount of vegetation, litter, rock, bare ground, or water cover present at the ground surface. The results of the 1994 and 1995 basal cover sampling at EcMP sites are shown in Table 7. The 1993 basal cover data were not included because of sampling inconsistencies associated with the data set (Appendix B).

Litter provided the greatest amount of ground cover at all sites and communities during 1994 and 1995 (Table 7). At the community level, the 1994–95 mean litter basal cover amounts ranged between 57 and 68 percent (Table 7), with the reclaimed grassland having the highest amount (68 percent; Table 7). At the community level, the 1994–95 mean vegetation basal cover ranged from a maximum of 24 percent in the mesic mixed grassland to a minimum of 9 percent in the reclaimed grassland (Table 7). Rocks provided 15–16 percent of the 1994–95 mean basal cover in all communities, and bare ground provided 3–8 percent of the basal cover in all communities (Table 7). Ground cover provided by water occurred only in the riparian woodland (1994–95 mean basal cover 3 percent; Table 7). Vegetation and litter basal cover amounts showed a decline in all communities from 1994 to 1995, with the exception of the mesic mixed grassland, which showed a slight increase (Table 7). Associated with these decreases were increases in the percentage of rock and bare-ground basal cover in all communities (Table 7).

Basal cover data revealed that the mesic mixed grassland provided more ground cover than the artificially created reclaimed grassland (Table 7). Significant differences (ANOVA, $\alpha = 0.05$ level) in the amounts of bare ground cover, vegetation cover, and litter were found between the reclaimed grassland and mesic mixed grassland in the 1994 data (DOE 1995a). The reclaimed grassland contained lower amounts of basal vegetation cover and higher amounts of bare ground and litter (Table 7). The reclaimed grassland is believed to have been mesic mixed grassland prior to cultivation, so these data indicate that the native mesic mixed grassland provides greater vegetation cover, and hence, greater potential protection of the soil surface from wind and water erosion, than the revegetated cover. Little et al. (1980) reported that wind erosion was a major mechanism for the transport of plutonium from contaminated soils at the Site. Thus, in revegetating contaminated areas at the Site, a more natural native grassland composition would be preferable from a safety standpoint, because it would provide greater protection of the soil surface from erosion and reduce the potential for wind-blown transport of soil contaminants.

Foliar, shrub, and tree cover are measures of the vegetation cover above the ground surface (vertical projection of the canopy to the ground). Results of the 1993–95 foliar cover sampling, grouped by EcMP site and community, are reported in Table 8. The highest 1993–95 mean foliar cover was found in the mesic mixed grassland (88 percent). The xeric mixed grassland, reclaimed grassland, and riparian woodland had 1993–95 mean foliar cover amounts of 84, 76, and 68 percent, respectively. Shrub cover was substantial only in the riparian woodland (1993–95 mean foliar cover of 40 percent), and tree cover was found only in the riparian woodland (1993–95 mean foliar cover of 19 percent).

Foliar cover amounts, grouped by species by EcMP site, are summarized by community in Tables 9–12. Frequency, relative cover, and absolute cover are reported for each species encountered (see Methods section for explanations of terms). In the xeric mixed grassland, the species providing the greatest foliar cover were needle-and-thread grass (*Stipa comata*), big bluestem (*Andropogon gerardii*), sun sedge (*Carex heliophila*), Canada bluegrass (*Poa compressa*), Porters aster (*Aster porteri*), little bluestem (*Andropogon* *scoparius*), and dalmatian toadflax (*Linaria dalmatica*) (Table 9). (Note: sun sedge and needle leaf sedge [*Carex eleocharis*] were combined, because in 1993, sun sedge was identified as needle leaf sedge.) In the mesic mixed grassland, the species that provided the greatest amount of foliar cover were Japanese brome, western wheatgrass, blue grama (*Bouteloua gracilis*), wild alfalfa (*Psoralea tenuiflora*), and needle-and-thread grass (Table 10). In the reclaimed grassland, smooth brome (*Bromus inermis*) and intermediate wheatgrass (*Agropyron intermedium*) dominated the foliar cover (Table 11). In the riparian woodland, the greatest amounts of foliar cover were provided by baltic rush (*Juncus balticus*), Canada thistle (*Cirsium arvense*), Canada bluegrass, Nebraska sedge (*Carex nebrascensis*), meadow fescue (*Festuca pratensis*), and redtop (*Agrostis stolonifera*) (Table 12). Variations in foliar cover between sites are discussed in the specific community sections. Vegetation classification and ordination information by site and community were reported and discussed in the 1995 EcMP annual report (DOE 1995a) and are not repeated here.

Shrub cover (woody plants <2 m in height) was present in all of the communities, although in the grasslands it provided only about two percent cover (Table 8). Only two shrub species were recorded in the grasslands—prairie wild rose (*Rosa arkansana*) and Spanish bayonet (*Yucca glauca*) (Table 13). In the riparian woodland, nine different species of shrubs were recorded, with the most cover provided by coyote willow (*Salix exigua*), leadplant (*Amorpha fruticosa*), and young plains cottonwood (*Populus deltoides*) (Table 13). Tree cover (woody plants >2 m in height) was recorded only in the riparian woodland community (Table 8). Plains cottonwood and tall shrubs of coyote willow provided the largest amounts of tree cover in the riparian community (Table 14).

The community with the greatest amount of foliar cover provided by native species was the xeric mixed grassland (82 percent; Table 15). The mesic mixed grassland and riparian woodland communities had approximately the same amounts of native foliar cover, with 55 and 54 percent, respectively (Table 15). The reclaimed grassland had the lowest amount, with only three percent native foliar cover (Table 15). The site with the highest native foliar cover was TR01 (89 percent; Table 15), a xeric mixed grassland site, while TR09, a reclaimed grassland site, had the least amount of native foliar cover (one percent; Table 15). All three grassland communities showed a decrease in the percentage of native foliar cover over the three-year period. (Table 15). This was mirrored at each grassland site, with the exception of reclaimed grassland sites TR08 and TR09, which showed minute increases in 1995 (Table 15). Only the riparian woodland showed a community level increase in the percentage of native foliar cover (Table 15). The site with the greatest decrease in native foliar cover was TR11, a mesic mixed grassland site, which showed a 30 percent decrease in native foliar cover (Table 15). Site TR05, a riparian woodland site, had the greatest increase (26 percent) in native foliar cover (Table 15). Concerns about the apparent loss of native vegetation cover are discussed by specific community in later sections.

BIOMASS

Biomass production is a measure of the amount of above-ground plant material produced during a given growing season. Mean total biomass production for 1993–94 at the EcMP sites (Table 16) was highest in the reclaimed grassland community (130 g/m^2), followed by the xeric mixed grassland (126 g/m^2) and the mesic mixed grassland (119 g/m^2). No biomass sampling was conducted in the riparian woodland community. Biomass production results were higher in 1994 than in 1993 across all communities (Table 16). In 1993, biomass production was highest in the xeric mixed grassland (124 g/m^2), followed by the mesic mixed grassland (117 g/m^2) and the reclaimed grassland (114 g/m^2; Table 16). In 1994, the reclaimed grassland had the highest biomass production (146 g/m^2; Table 16). This was followed by the xeric mixed grassland and mesic mixed grassland, with 129 and 120 g/m^2, respectively (Table 16). The 1993–94 mean litter biomasses ranged between 189 and 191 g/m^2 (Table 16). Litter biomass was higher across all communities in 1994 than in 1993 (Table 16). Although the differences in litter amounts between years seemed dramatic, they were best explained by differences in sampling methods. During the second year of sampling (1994), field personnel collected litter much more meticulously, resulting in the higher amounts, and thus the data do not necessarily indicate a significant ecological trend.

Biomass amounts by species were only available for 1994, and are presented in Table 17. The ten leading biomass producers in the xeric mixed grassland during 1994 were needle-and-thread grass, dalmatian toadflax, dotted gayfeather (*Liatrus punctata*), field alyssum, big bluestem, Canada bluegrass, hairy goldenaster, Porters aster, sun sedge, and little bluestem (Table 17). In the mesic mixed grassland, the ten leading biomass producers for 1994 were western wheatgrass, Japanese brome, blue grama, musk thistle (*Carduus nutans*), sun sedge, white sage (*Artemisia ludoviciana*), needle-and-thread grass, big bluestem, false salsify, and Canada bluegrass (Table 17). Two species, smooth brome and intermediate wheatgrass, dominated the biomass of the reclaimed grassland (Table 17). The leading biomass producers in each community corresponded well with the species providing the greatest cover in each community (Tables 9–12).

Large differences were found between communities in the amount of biomass produced by native species. The highest amount of biomass from native species was produced in the xeric mixed grassland (mean = 74 percent; Table 17). The mesic mixed grassland had 63 percent of the biomass from native species, while the reclaimed grassland had less than one percent of biomass produced by native species (Table 17).

PLANT COMMUNITIES

Xeric Mixed Grassland

The xeric mixed grassland represented approximately 31 percent of the Site land area, based on the 1996 updated vegetation types map (Figure 2) (Appendix A provides details of map production methods and classification descriptions). The three sites sampled were TR01, TR06, and TR12 (Figure 1). The xeric mixed grassland occurs primarily on the pediments (flat hilltop areas) and on ridgetops at the Site (Figure 2). The pediment is underlain by the Rocky Flats Alluvium and has soil types classified as Flatirons very cobbly sandy loam on the flatter surfaces, and Nederland very cobbly sandy loam along the ridgetops and pediment edges (SCS 1980).

The xeric mixed grassland had the lowest species richness of the native plant communities (excluding the reclaimed grassland), with a combined richness of 134 species identified in 1995 (Table 3). It had the highest percentage of native species richness (83 percent, 1995; Table 4) of all the communities. A total of 23 species (91 percent of these were native species) were recorded only in the xeric mixed grassland sites during the three years (Table 5). The predominant life and growth forms of vegetation on the xeric mixed grassland were perennial graminoids and forbs (Table 4).

The highest cacti densities and greatest number of cacti species were found in the xeric mixed grassland, further indicating the dry hydrologic character of this community (Tables 6 and 4, respectively).

Although TR01, TR06, and TR12 were all categorized as xeric mixed grassland, differences in cover and biomass data from these sites revealed that species composition varied in the community across the Site (Tables 9 and 17). As reported in the 1995 EcMP annual report (DOE 1995a), based on the 1994 data, TR01 and TR06 differed from one another based on dominant cover species. This was further supported by the 1993 and 1995 data (Table 9). The TR01 site contained a high cover of big bluestem and little bluestem, both tallgrass prairie species, during all three years. TR06 contained very few of either of these species, but instead had high cover of needle-and-thread grass and dalmatian toadflax (Table 9). The TR12 site was intermediate between the two, with high cover of big bluestem and needle-and-thread grass (Table 9). Differences in the 1994 biomass production by these species revealed similar differences between the sites as well (Table 17). These differences were used as a determining factor in splitting the xeric mixed grassland into two separate classifications for the 1996 updated vegetation types map (Figure 2). Areas similar to TR01 and TR12 were classified as xeric tallgrass prairie, based on the high cover of big bluestem and little bluestem. Locations with high cover of needle-and-thread grass and very little cover of bluestems were classified as xeric needle-and-thread grass prairie.

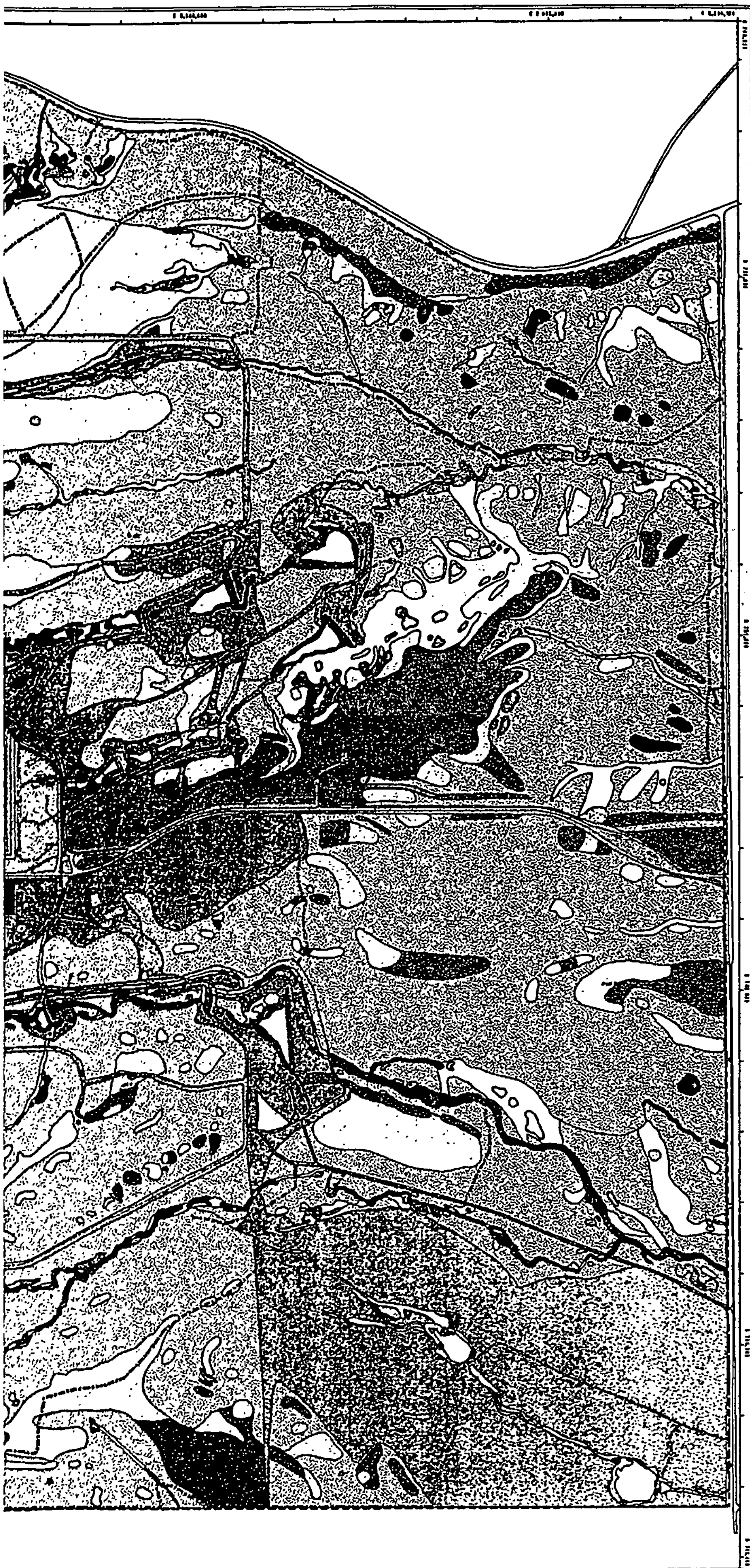


Figure 2. Vegetation Types Map 1996

LEGEND

- Xeric Tallgrass Prairie
- Xeric Needle and Thread Grass Prairie
- Mesic Mixed Grassland
- Reclaimed Grassland
- Short Grassland
- Annual Grass/Forb Community
- Wet Meadow/Marsh Ecotone
- Short Marsh
- Tall Marsh
- Short Upland Shrubland
- Tall Upland Shrubland
- Savannah Shrubland
- Leadplant Riparian Shrubland
- Willow Riparian Shrubland
- Riparian Woodland
- Ponderosa Woodland
- Disturbed and Developed Areas
- Mudflats
- Riprap, Rock, and Gravel Piles
- Tree Plantings
- Open Water

Standard Map Features

- Buildings or other structures
- Fences
- Rocky Flats boundary
- Paved roads
- Dirt roads

DATA SOURCE:
Vegetation map data provided by PTI Environmental Services Ecology Group.
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. - 1991.
Hydrology provided by USGS - (date unknown).

NOTE:
This map does not show all Federally designated wetlands. See the 1996 Site wetlands map prepared by the U.S. Army Corps of Engineers for delineated wetland features.

Scale = 1 : 20620
1 inch represents approximately 1718 feet

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

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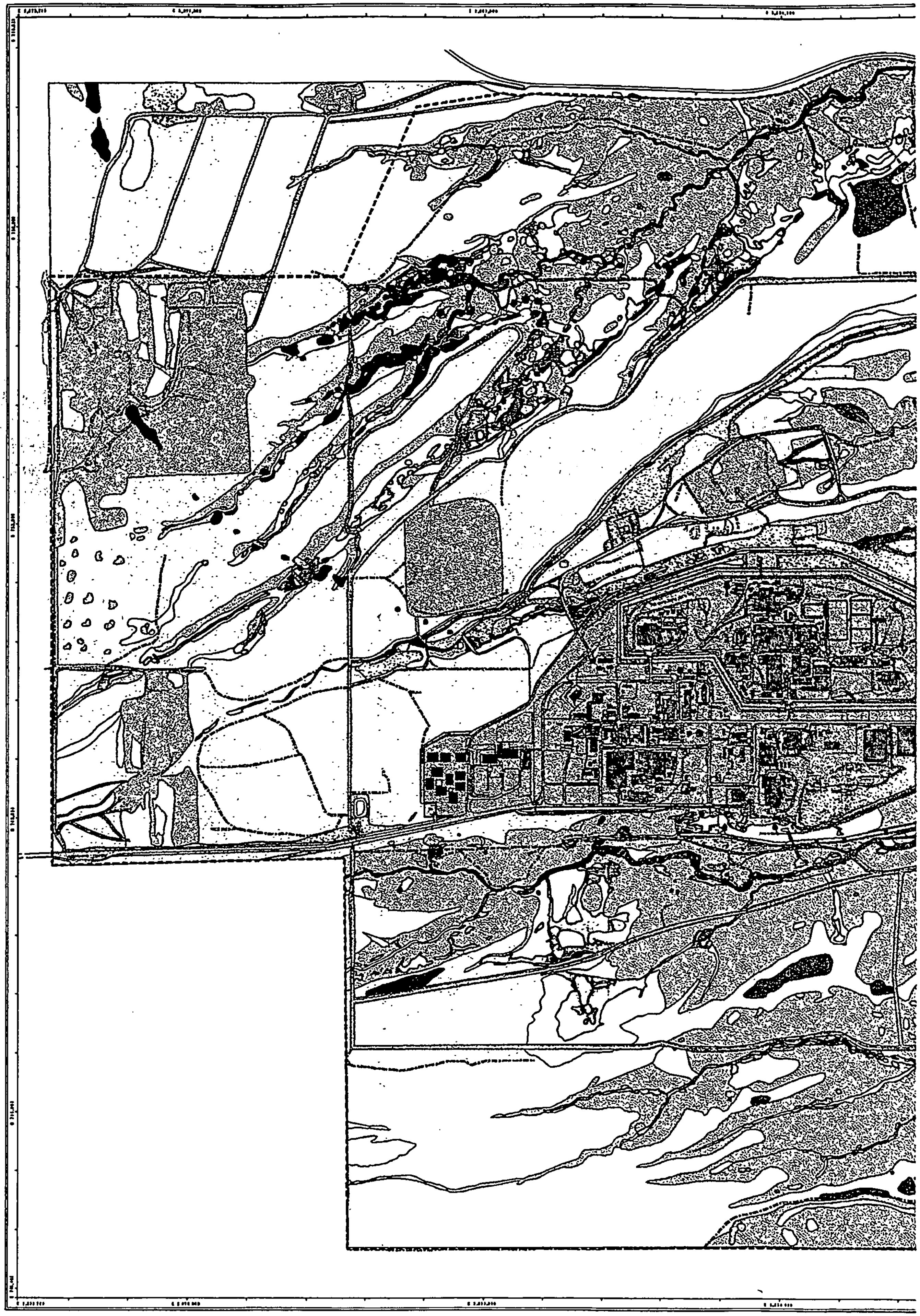
MAP ID: 97-0044

March 19, 1997



The xeric tallgrass prairie portion of the xeric mixed grassland is a significant ecological resource at the Site, because it was once part of a larger xeric tallgrass prairie ecosystem stretching along the Colorado pediment. Much of this ecosystem has been destroyed by human activity and development (CNHP 1995). Most of what remains of this ecosystem consists of small parcels ranging in size from 5 to 100 acres (CNHP 1995). The xeric tallgrass prairie portion of the xeric mixed grassland at the Site covers approximately 1,800 acres (Table 18; Figure 2) and represents a large parcel of what remains of this rare ecosystem. Colorado Natural Heritage Program (CNHP) ecologists identified the xeric tallgrass prairie at the Site as globally imperiled; it is one of fewer than 20 known locations worldwide (CNHP 1995).

The xeric needle-and-thread grass prairie portion of the xeric mixed grassland covers approximately 189 acres at the Site (Table 18), with the largest portion represented by the area near TR06 (Figure 2). The higher amounts of cover and biomass of non-native species (28 and 54 percent respectively; Tables 9 and 17) at the TR06 site are an important management concern in this community. Dalmatian toadflax provides the second highest cover and highest biomass at TR06 (Tables 9 and 17). Weed control is a prime concern at this locality because of the large weed infestations present there.

Statistical trend analysis of foliar cover data for individual species was not conducted because of difficulties in separating out annual environmental variability, sample variability, sampling error, and problems associated with interpreting such a short-term trend (three years). However, qualitative assessments and interpretations of dramatic changes in particular species or groups of species could indicate changes in community composition that may warrant management action. The most apparent trend in the xeric mixed grassland is the consistent decrease in the percentage of native foliar cover at all the xeric mixed grassland sites over the three years (Table 15). Losses of native cover ranged from approximately 5 to 17 percent.

The greatest loss of native cover occurred at TR12, where field alyssum, a non-native species, showed a large increase in cover and frequency over the three years, while little bluestem, hairy goldenaster, wild alfalfa, and Fendler sandwort (*Arenaria fendleri*), all native species, showed losses in cover (Table 9). At TR06, increases in the cover of non-natives species, including Japanese brome, small-seeded false flax, and dalmatian toadflax, combined with losses in native cover of needle-and-thread grass, accounted for much of the change at that site (Table 9). At TR01, the increase in cover of the native species Porters aster offset losses by other native species, reducing the overall loss of native cover at the site to about 5 percent (Table 9). Little bluestem, hairy goldenaster, dotted gayfeather, wild alfalfa, and Fendler sandwort, all native species, showed declines of foliar cover greater than 50 percent at TR01 over the three-year period (Table 9). The apparent decrease in the cover of little bluestem at TR01 and TR12 was particularly noteworthy, because it is one of the important tallgrass species of the xeric tallgrass prairie. During the 1995 sampling season, Nelson (1996) observed many deaths of the species, apparently as a result of the late summer drought in 1994. Similar responses of little bluestem to drought were mentioned by Albertson and Weaver (1944), who suggested drought losses were due to the shallow root system of the species.

The apparent loss of native cover in the xeric mixed grassland must be viewed in light of the dynamic nature of the ecosystem. During the three years studied, a drought occurred in the summer of 1994, and above-average spring rainfall—and runoff with associated flooding—occurred in 1995. Studies documenting the response of the native prairie and successional recovery of abandoned fields and roads to periods of drought and above-average rainfall reveal the dynamic nature of the plant communities (Albertson and Weaver 1944; Shantz 1917; Reichhardt 1982). Albertson and Weaver (1944) documented dramatic annual changes in the cover of different prairie graminoid and forb species in response to drought during the 1930s and early 1940s. It is not apparent whether the observed changes in the xeric mixed grassland data indicate larger changes in the species composition of the community, or if these changes manifest the natural variation in the annual production of these species due to life history traits or environmental factors, indicate a lack of grazing or fire in the ecosystem, or result from sampling "noise." Longer-term monitoring correlated to other measured variables (e.g., climate data, management practices) would be required to discriminate among these causes.

The apparent loss of native foliar cover in the xeric mixed grassland is an important concern, which may indicate that continued monitoring of the community is needed. In addition, steps must be considered to control the weeds and improve the health of the native species. Current management plans include monitoring of the xeric mixed grassland, controlling weeds, and reintroducing fire to the ecosystem. These strategies should help reduce the weeds and other non-native species while enhancing the vigor and health of the native species in the plant community (K-H 1997).

Mesic Mixed Grassland

The mesic mixed grassland represented approximately 34 percent of the Site land area, based on the 1996 updated vegetation types map (Figure 2) and is the largest plant community (in areal extent) at the Site. The three mesic mixed grassland sites sampled were located at TR02, TR04, and TR11 (Figure 1). The mesic mixed grassland occurs primarily on the hillsides (Figure 2), on soil types classified primarily as Denver-Kutch-Midway clay loams and Haverson loam, with isolated locations of Denver clay loam, Nunn clay loam, and Leyden-Primen-Standley cobbly clay loam (SCS 1980).

The mesic mixed grassland had a combined richness of 141 species identified in 1995 (Table 4), which was intermediate between the xeric mixed grassland and riparian woodland. Eighty-two percent of the species were native (1995; Table 4). A total of 16 species (88 percent of these native species) were recorded only in the mesic mixed grassland community over the three years (Table 5). The predominant life and growth forms of vegetation on the mesic mixed grassland were perennial graminoids and forbs, in proportions similar to those found in the xeric mixed grassland (Table 4). In general, the mesic mixed grassland fell between the xeric mixed grassland and riparian woodland for most species richness measures (Table 4).

The dominant species at all three mesic mixed grassland sites were Japanese brome and western wheatgrass, with Japanese brome providing the greater cover at TR04 and TR11 and western wheatgrass providing slightly more cover at TR02 (Table 10). Differences among the mesic mixed grassland sites were generally less distinct than those among the xeric mixed grassland sites (Tables 3, 10, and 17). Although the mesic mixed grassland had the highest three-year mean foliar cover (88 percent; Table 8) of all the communities, a substantial portion of the relative foliar cover was from non-native species (45 percent; Table 15). Only 65 percent of the total biomass production in the mesic mixed grassland community was from native species (Table 17). Similar to the xeric mixed grassland, the mesic mixed grassland showed a decrease in the overall percent of native foliar cover over the three-year period (Table 15). Much of the loss of native cover was attributable to increases in foliar cover by Japanese brome, a non-native species, combined with loss of foliar cover by western wheatgrass and blue grama, both native species (Table 10). The combined cover of the two non-native annual species of cheatgrass—Japanese brome and downy brome (*Bromus tectorum*)—provided 20 to 38 percent of the foliar cover during each year of sampling at the mesic mixed grassland sites (Table 10). The two species of cheatgrass combined also provided the second highest amounts of biomass in the community, behind western wheatgrass, further indicating the strong non-native influence in the community (Table 17). The high native species richness (Tables 3 and 4) indicates that while the mesic mixed grassland still retains a large native floristic component, the high non-native cover and biomass present in the community indicates its degraded state (Tables 10 and 17). The loss of native foliar cover in the mesic mixed grassland, like that in the xeric mixed grassland, is cause for concern and needs further examination.

The dominance of the mesic mixed grassland community by cheatgrasses is significant from ecological, management, and safety standpoints. Cheatgrasses have become the dominant species on thousands of acres of rangeland in the western U.S. since their introduction to North America more than 100 years ago (Pellant and Hall 1994). Studies have shown that the germination requirements and competitiveness of the cheatgrasses allow them to replace the native vegetation and, once established, cheatgrass is difficult to eradicate (Rosentreter 1994; Monsen 1994; Haferkamp et al. 1994). This fact is evident at the Site, where large portions of the mesic mixed grassland are dominated by cheatgrasses. Much of the current state of the mesic mixed grassland can be traced back to past land-use practices (overgrazing, farming, disturbance, water regime alteration) at the Site.

Prior to the purchase of the Site and building of the Industrial Area, the land served primarily as rangeland, with some farming in the southeast corner. Overgrazing (prior to DOE purchase), combined with the semi-arid climate, provided optimal conditions for the cheatgrasses and other weeds to invade and establish in the mesic mixed grassland at the Site since grazing was stopped. Clark et al. (1980) mentioned the overgrazed condition of the land (as of 1974) and reported overgrazing as one of the key factors influencing the vegetation on the Site at that time. She also observed what Weaver and Clements (1938) had stated, that under a heavy grazing regime, the mixed grass prairie is replaced by shortgrass vegetation, but when released from grazing pressure, the mixed grass prairie returns (Clark et al. 1980). Much of what is currently called the mesic mixed grassland at the Site was classified as shortgrass prairie by Clark et al. (1980). With the removal of grazing pressure, much of the mesic mixed grassland has begun to recover from its previously overgrazed, shortgrass state, although the establishment of many weeds and other non-native species has accompanied and slowed the successional return to a more mixed grass prairie state.

Ecologically, the replacement or inhibition of the native species, many of which are perennial species, by an annual community (including cheatgrasses, diffuse knapweed [*Centaurea diffusa*], and other weeds), results in many significant changes to the community. Studies in other locations have shown that these changes include the loss of genetic, species, and structural diversity in the community, which can lead to lowered ecosystem stability, alteration of landscape patterns of vegetation, loss of wildlife habitat, and declines in some wildlife populations (Rosentreter 1994). The conversion to an annual community also results in lower quality watersheds with higher potential for soil erosion, because the deep, soil-holding root systems of the perennial species are no longer present (Rosentreter 1994). These are all important issues with regard to the management of soil, water, and ecological resources at the Site.

From a safety standpoint, wildfires are one of the major concerns created by the cheatgrass-dominated communities at the Site. As annuals, the cheatgrasses complete their lifecycles early in the growing season, leaving a standing crop of dead, dry plant litter in the community for most of the summer. In the areas at the Site dominated by cheatgrasses, the biomass from these species is a significant portion of the total biomass produced (Table 17). The result is that large fuel loads are available in the community throughout the year. The mesic mixed grassland dominates most of the hillsides and the eastern grassland areas in the Buffer Zone (Figure 2). Studies have shown that communities dominated by annuals have a greater fire frequency than areas dominated by perennials (Monsen 1994; Rosentreter 1994). The September 2, 1996 grassland fire in the south Buffer Zone was a lightning-caused wildfire that burned over 100 acres at the Site. This wildfire started in the mesic mixed grassland. From a fire mitigation standpoint, management of the type of vegetation present in the mesic mixed grassland is a significant concern.

Based on the current state of the mesic mixed grassland, management and conservation of this community must take into consideration the factors mentioned above. Although not a high priority for specific management (K-H 1997), some actions could be taken to further improve the quality of the mesic mixed grassland. The effects of past overgrazing practices and the semi-arid climate will make resolving this problem challenging, because the cheatgrasses and other weed species (e.g., knapweed) are adapted to semi-arid climates found in their native Eurasia (Monsen 1994). Reseeding of cheatgrass-infested areas with native forbs and grasses, combined with herbicide applications and appropriate use of controlled burns, have shown some success in rehabilitating these types of areas (Monsen 1994). Increasing the moisture available for plant growth (e.g., irrigation), in conjunction with reseeding, would also help speed the recovery of the grassland (Clark et al. 1980). In order to sustain and preserve the native species diversity in the mesic mixed grassland, reduce the weeds, and reduce the wildfire potential at the Site, these and other possible management practices will need to be considered.

Riparian Woodland

Riparian woodland represents less than 1 percent of the total area of the Site, based on the 1996 updated vegetation types map (Table 18; Figure 2). The riparian woodland sampled by the EcMP consisted generally of what was classified in Figure 2 as riparian woodland, leadplant riparian shrubland, and willow riparian shrubland. Although short upland shrubland and small patches of short marsh, wet meadow/marsh ecotone, and tall marsh were occasionally interspersed along the stream channels, they were not included in the total area determinations. This omission was made because these vegetation types occur in large areas away from the stream channel. The riparian woodland sites sampled during 1993–95 included TR03, TR05, and TR10 (Figure 1). Because of the linear nature of the riparian woodland, transects at these sites often were placed at different locations along the drainages to incorporate variations in the habitat present. Soil types in the riparian woodland areas are primarily Haverson loam and Engelwood clay loam (SCS 1980).

The riparian woodland had the highest species richness of all the communities, with a combined species richness of 196 species identified in 1995 (Table 4). The riparian woodland had only 73 percent native species (1995; Table 4), the lowest percentage of native species of all the native communities (excluding the reclaimed grassland). The lower percentage of native species in the riparian woodland was likely a result of past disturbances and land use. Grazing, which previously occurred in all drainages, would have allowed the introduction and establishment of some non-native species. Stream alteration (stream channelization, pond construction, riprap additions) in the Walnut Creek drainage at TR05 also would have destroyed some native habitat and created disturbed areas where non-native species could have become established. In general, the streams themselves provide a good mechanism for plant dispersal, which could also explain the higher non-native species richness along the riparian corridors. Increased wildlife densities and use of the riparian woodlands and shrubland areas by wildlife probably account for some of the greater percentage of non-native species, because the wildlife would act as seed dispersers. The highest number of species found in only one community over the three years was in the riparian woodland (113 species; 82 percent native species; Table 5) and is best explained by the high moisture availability found in the riparian woodland. Examination of the species found only in the riparian woodland revealed that many of the species were plants commonly found in wetlands at the Site (Table 5). The riparian woodland was the only community to show an increase in the percent of native foliar cover over the three-year period (Table 15). The riparian woodland was also the only community sampled that had significant vertical stratification that included shrub and tree species (Table 8). The subjective selection of site locations make it difficult to draw any definitive conclusions about the differences in shrub and tree cover. The differences in frequency and foliar cover amounts for the dominant species in each drainage may reflect the manner in which sites were selected, rather than truly representing differences between the drainages (Tables 13 and 14).

Site TR05, in the Walnut Creek drainage, had the most depauperate flora of the three riparian woodland sites, with the lowest number of families and species represented (Tables 3 and 4). The number of species found at TR05 decreased over the three-year period, compared to the large number of additional species found at TR03 and TR10. The increase in species richness at TR03 and TR10 (Table 4), as well as at many other sites, was best explained as resulting from increasing familiarity of sampling personnel with the Site flora over time. No reason is apparent reason for a similar increase in species richness not being found at TR05. Examination of the riparian sites' species lists revealed no particular pattern or group of species that was missing from TR05, other than that TR05 had a lower percentage of native species richness (Table 3). TR05 also had the lowest amounts of foliar cover, basal vegetation cover, and litter cover (Tables 7 and 12).

Many of the differences between the riparian woodland sites are probably best explained by historical land management practices, specific to each drainage, which have included such activities as grazing, stream channelization, and alteration of the water flow regime. Historical aerial photos taken in 1937 and 1951, before construction of Site facilities, show little riparian woodland development in all three drainages, with the exception of the very upper reaches of Rock Creek. By 1972, however, with the cessation of grazing and building of the industrial area, the aerial photos show trees beginning to grow in all three drainages. The 1972 photo also shows that while Rock Creek (TR03) and Smart Ditch (TR10) were left relatively untouched by human disturbances (and still are), Walnut Creek (TR05) was heavily impacted by the building of ponds and alteration of the stream channel in the bottom of the drainage and upland disturbances on nearby hillsides. These disturbances, along with the artificial flow regime present in Walnut Creek, probably account for much of the lowered species richness and greater impact of non-native species.

The riparian woodland community has been designated as a plant community of special concern (Great Plains Riparian Woodland) by the CNHP because of its increasing rarity due to overgrazing and development (CNHP 1995). Although it is affected somewhat at the Site, the community provides important habitat for many bird and mammal species, including a number of populations of the rare Preble's meadow jumping mouse (K-H 1996).

Reclaimed Grassland

The reclaimed grassland community represents approximately 10 percent of the total area of the Site, based on the 1996 updated vegetation types map (Table 18; Figure 2). The reclaimed grassland sites sampled from 1993 through 1995 included TR07, TR08, and TR09 (Figure 2), located in old farm fields in the southeast corner of the Site. Originally outside the 1950s Buffer Zone boundaries, the reclaimed grassland area was included in a 1974 purchase that increased the size of the Buffer Zone. After purchase, the land was no longer farmed, and based on best estimates, was planted with reclamation seed mixtures in 1975 to prevent wind and water erosion. Soil types in the reclaimed grassland were classified as Standley-Nunn gravelly clay loams and Denver-Kutch clay loams (SCS 1980).

The reclaimed grassland had the lowest species richness of all the communities (Table 4). It had a combined species richness of 63 species identified in 1995 (Table 4). The reclaimed grassland had only a 59 percent native species richness in 1995 (Table 4) and consistently had the lowest percent native species richness of all the communities sampled during the three-year period. Only four species, two of them native, were found growing exclusively at the reclaimed grassland sites over the three years (Table 5). The predominant life and growth forms of vegetation on the reclaimed grassland were perennial forbs and graminoids (Table 4).

The reclaimed grassland showed 59 percent native species richness in 1995 (Table 4), but taken alone, this statistic is misleading in describing the community composition. The most striking observation in the reclaimed grassland was the total domination of the community by two non-native perennial grasses, which were seeded approximately 20 years ago. Smooth brome and intermediate wheatgrass had combined foliar cover amounts ranging from 73 to 97 percent of the vegetation cover at individual sites during the three years of sampling (Table 11). These two species provided a combined three-year mean foliar cover of 87 percent in the reclaimed grassland (Table 11). The fact that all native species combined provided only an average of 3 percent of the foliar cover in the reclaimed grassland (Tables 11 and 15), and less than 1 percent of the biomass (Table 17), reveals the highly altered state of the community. Successionally, the return of the reclaimed grassland to a mesic mixed grassland has been retarded by the aggressive nature of these non-native species. Very few native species have been able to reestablish within the community (Tables 11 and 17). Also interesting was the low foliar cover of other weed species, such as the cheatgrasses, musk thistle, Canada thistle, and various mustards, which are more common in the mesic grasslands surrounding the reclaimed grassland areas (Table 11). The aggressive and competitive nature of smooth brome and intermediate wheatgrass allowed them to keep even the weeds out.

Studies examining successional progression on old agricultural fields and abandoned roads on the eastern plains of Colorado suggest that 50 years or more are required for natural successional processes to return an abandoned field to its native state (Shantz 1917; Reichhardt 1982; Costello 1944; Judd 1974; Albertson and Weaver 1944). However, many factors influence the speed at which recovery takes place. Distribution and timing of precipitation, wind movement and drifting soils, the number of years of cultivation, surrounding land use, grazing pressure, type of grazer, rodents, insects, topography, slope, and soil types are all important factors that affect the recovery rates of grasslands in eastern Colorado (Costello 1944). Direct comparison of the reclaimed grassland at the Site to the successional stages described in these studies is complicated by the fact that the reclaimed grassland was seeded, not simply abandoned. The planted species would certainly have an influence on what native or non-native species have been able to re-establish. However, some important lessons can be learned that may be applicable to future revegetation concerns at the Site. Four to six successional stages were identified in three of the earlier studies (Judd 1974; Shantz 1917; Costello 1944; Table 19).

Based on the natural succession rates in Table 19, the reclaimed grassland should have been nearing the early stages of a perennial climax mixed prairie community if nothing had been done to the old agricultural fields (based on 20 years of growth). The area occupied by the reclaimed grassland is thought to have been a mesic mixed grassland prior to cultivation, and thus, the climax species would be more of a shortgrass/midgrass mix composed of blue grama and western wheatgrass, along with other native species typically found in the mesic mixed grassland at the Site today. However, the species richness and composition of the reclaimed grassland today remains considerably different from the mesic mixed grassland at the Site (Tables 3, 10, 11, and 17). Species richness in the reclaimed grassland was less than half of that in the mesic mixed grassland, and although 62 percent of the reclaimed grassland species were native, native foliar cover was only one-twentieth, and native biomass less than one-sixtieth, of that found in the mesic mixed grassland (Tables 3, 11, and 17). The planting of smooth brome and intermediate wheatgrass has dramatically inhibited the natural succession of these old fields to a more native grassland. Based on the current status of the reclaimed grassland, it could potentially take a century or more, depending on the factors listed above, for it to return to its native state. It may never do so without intervention to re-establish the native species. This is important to note, in light of the DOE's goal of preserving the ecological resources and improving degraded habitat at the Site.

As Site cleanup progresses and the revegetation of caps and disturbed areas is planned, serious consideration must be given to the seed mixtures used for revegetation. It should be obvious from the reclaimed grassland data that smooth brome and intermediate wheatgrass should not be planted at the Site for any revegetation purposes. Besides retarding re-establishment of the native prairie, as previously mentioned, the reclaimed grassland has lower potential for erosion control because of its lower basal vegetation cover and higher amounts of bare ground, compared to the native mesic mixed grassland (Table 7). Revegetation with native species and re-establishment of the native grassland communities, as well as possible, will provide the best long-term solutions in terms of both ecological and practical functionality. The use of native species will also comply with DOE orders and with the Ecological Resource Management Plan for the Site (K-H 1997). For short-term ground and erosion cover, annual species such as common rye

(*Secale cereale*) or cultivated oats (*Avena fatua* var. *sativa*) could be used. These species survive only a year and do not replace the native species in the plant communities.

The findings from the reclaimed grassland agree with other studies that have examined the dominance of smooth brome in native prairie ecosystems (Grilz and Romo 1994; Blankespoor and Larson 1994; Sather 1988). Sather (1988) outlined the threats posed by smooth brome being used as a revegetation species and reported on its invasive, aggressive ability to dominate plant communities, replacing the native species. Blankespoor and Larson (1994) and Grilz and Romo (1994) studied the response of smooth brome to fire in an attempt to identify management techniques that would reduce the competitive nature of the species. Blankespoor and Larson (1994), in studying a tallgrass prairie remnant dominated by warm-season grasses, found that spring burning with either high or low water availability decreased the amounts of smooth brome in the plant community. However, without burning, the smooth brome increased under both high and low water availability. Grilz and Romo (1994) found no significant difference in smooth brome amounts between control and burn treatments on a Fescue-dominated grassland (cool season grasses).

The species composition of the native grassland has a significant effect in determining how successful the use of fire will be in controlling the smooth brome, which itself is a cool-season grass species (Sather 1988). This information has important consequences at the Site in terms of managing the reclaimed grassland. Although it may not be a high priority to reclaim the grassland back to a more native state, the larger problem may be preventing its expansion at the Site. Nelson (1996) observed that in some locations where smooth brome has been planted to revegetate disturbances, there are "islands" of nearly pure stands of smooth brome established in the native grasslands downwind of the revegetated areas. Additionally, Murdock (1996), based on observations from 1991 to 1996, suggested that even in areas isolated from historical revegetation efforts at the Site, smooth brome has become established in dense patches, which appeared to expand over the years. Additional monitoring is necessary to determine if these "islands" are actually expanding and whether new "islands" are being created, further degrading the native grasslands at the Site. Because DOE's goal is to maintain and sustain the current ecological resources at the Site, future control efforts may be necessary to prevent the spread of smooth brome into the native plant communities. Potential actions that could be taken might include reseeding the reclaimed grassland with native species, irrigating the field to help re-establish native species, treating with herbicides, treatments using controlled burns, or designing a combination of these techniques.

SUMMARY

The EcMP sampled the xeric mixed grassland, mesic mixed grassland, reclaimed grassland, and riparian woodland communities at the Site from 1993 through 1995, characterizing species richness, vegetative cover, and biomass production (no biomass sampling was conducted in the riparian woodland community). Many other plant communities at the Site were not sampled. The data revealed differences in the vegetation between the four communities:

- The xeric mixed grassland had the highest number of native species and the highest percent vegetation cover and biomass production by native species, indicating its high quality among the communities sampled. The high cover and biomass amounts of the tallgrass prairie species—big bluestem and little bluestem—at locations in the xeric mixed grassland were instrumental in helping to identify the tallgrass prairie relict at the Site as a unique ecological resource worthy of protection.

- The mesic mixed grassland, while still containing a large remnant of the native flora, was somewhat degraded by the high cover and biomass amounts of cheatgrass, likely brought about by past overgrazing. Control and reduction of the cheatgrass and other weeds in the mesic mixed grassland would greatly improve the quality of this community.

- The woodlands and shrublands in the riparian community at the Site have developed largely since the DOE purchased the property, ended grazing, and in some cases, altered stream channels and stream flow. The riparian community, while having the highest species richness of all the communities, also had the lowest percentage of native species. Native cover in the riparian community was similar to that found in the mesic mixed grassland, indicating its somewhat degraded quality.

- The reclaimed grassland, an area of old agricultural fields, was shown to be a greatly altered community. It had the lowest species richness, lowest percentage of native species, and lowest amounts of native vegetation cover and biomass of all the communities. Based on its current successional state, with no intervention, it is estimated that the reclaimed grassland could take more than 100 years to resemble the more native grasslands at the Site, because of the aggressive nature of

the smooth brome and intermediate wheatgrass that dominate the area. The presence of a smooth brome seed source at the Site may also pose a continued threat to the native grassland communities at the Site.

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Tables

TABLE 1. ECMP SAMPLE SITE CODES, COMMUNITY TYPE, AND WATERSHED DESIGNATIONS

	Community Type			
Watershed	Xeric	Mesic	Riparian	Reclaimed
Rock Creek	TR01	TR02	TR03	
Walnut Creek	TR06	TR04	TR05	
Smart Ditch	TR12	TR11	TR10	TR07, TR08, TR09

TABLE 2. VEGETATION SAMPLING CONDUCTED AT EcMP TRANSECTS, 1993–1995

Sample Type	Spring 1993	Summer 1993	Spring 1994	Summer 1994	Spring 1995	Summer 1995
Species Richness (Belt transects)	X	X	X	X	X	X
Cover (Point-intercept transects)		X		X		X
Biomass (Production plots)		X		X		
Plant Nutrient Analysis (Production plots)	X	X				

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TABLE 3. SPECIES RICHNESS COMPARISONS AT ECMP SITES FOR 1993, 1994, & 1995

SCIENTIFIC NAME	SPEC-CODE	NATIVE	Xeric Sites									Mesic Sites									Riparian Sites									Reclaimed Sites								
			TR01	TR01	TR01	TR06	TR06	TR06	TR12	TR12	TR12	TR02	TR02	TR02	TR04	TR04	TR04	TR11	TR11	TR11	TR03	TR03	TR03	TR05	TR05	TR05	TR10	TR10	TR10	TR07	TR07	TR07	TR08	TR08	TR08	TR09	TR09	TR09
			93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95
AGAVACEAE																																						
Yucca glauca Nutt.	YUGL1	Y				X	X	X				X	X	X				X	X	X				X						X	X	X	X	X	X			
ALISMATACEAE																																						
Sagittaria sp.	SAG1																						X															
ANACARDIACEAE																																						
Rhus aromatica Ait. var. trilobata (Nutt.) A. Gray	RHAR1	Y	X	X	X																X	X	X				X	X	X									
Toxicodendron rydbergii (Small ex Rydberg) Greene	TORY1	Y																									X	X	X									
APIACEAE																																						
Cicuta maculata L.	CIMA1	Y																			X	X	X															
Conium maculatum L.	COMA1	N																			X			X	X	X												
Harbouria trachypleura (Gray) C. & R.	HATR1	Y							X			X																										
Heracleum sphondylium L.	HESP1	Y																					X															
Lomatium orientale Coult. & Rose	LOOR1	Y		X	X		X	X		X	X		X	X		X	X		X	X		X	X		X			X										
Musineon divaricatum (Pursh.) Nutt. ex T. & G.	MUDI1	Y											X	X		X	X		X	X																		
APOCYNACEAE																																						
Apocynum cannabinum L.	APCA1	Y																			X	X	X		X		X	X	X									
ASCLEPIADACEAE																																						
Asclepidaceae sp.	AS1																						X															
Asclepias incarnata L.	ASIN1	Y																				X	X					X										
Asclepias pumila (Gray) Vail	ASPU1	Y										X	X	X																			X	X	X			
Asclepias speciosa Torr.	ASSP1	Y																X		X	X	X	X	X	X	X	X	X	X				X		X			
Asclepias viridiflora Raf.	ASVI1	Y	X	X	X				X	X	X						X			X		X	X					X						X				
ASTERACEAE																																						
Achillea millefolium L. ssp. lanulosa (Nutt.) Piper	ACMI1	Y	X	X	X				X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X									
Ambrosia psilostachya DC.	AMPS1	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X						
Antennaria microphylla Rydb.	ANMI1	Y	X	X	X				X	X	X																											
Antennaria sp.	ANT1				X																																	
Arctium minus Bernh.	ARMI1	Y																					X															
Arnica fulgens Pursh.	ARFU1	Y			X											X			X	X		X			X			X										
Artemisia campestris L.	ARCA1	Y		X				X							X									X						X	X	X		X	X			
Artemisia dracunculus L.	ARDR1	Y				X	X	X				X	X	X	X	X	X	X	X	X	X	X		X	X	X	X			X	X	X	X	X	X	X	X	X
Artemisia frigida Willd.	ARFR1	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X						
Artemisia ludoviciana Nutt.	ARLU1	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X									
Aster ericoides L.	ASER1	Y	X	X	X		X			X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X			
Aster hesperius A. Gray	ASHE1	Y																					X						X									
Aster laevis L.	ASLA1	Y																					X															

1993 and 1994 species richness based on belt transect and production plot data combined. 1995 species richness based on belt transect and point-intercept data combined

TABLE 3. (cont.)

			Xeric Sites									Mesic Sites									Riparian Sites									Reclaimed Sites								
	SPEC-	NATIVE	TR01	TR01	TR01	TR06	TR06	TR06	TR12	TR12	TR12	TR02	TR02	TR02	TR04	TR04	TR04	TR11	TR11	TR11	TR03	TR03	TR03	TR05	TR05	TR05	TR10	TR10	TR10	TR07	TR07	TR07	TR08	TR08	TR08	TR09	TR09	TR09
SCIENTIFIC NAME	CODE		93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95
Aster occidentalis (Nutt.) T. & G.	ASOC1	Y																			X	X					X											
Aster porteri Gray	ASPO1	Y	X	X	X				X	X	X	X	X	X				X	X	X			X	X	X		X		X	X	X	X		X				
Aster sp.	AST1						X								X	X																		X				
Bidens frondosa	BIFR1	Y																								X												
Carduus nutans L.	CANU1	N				X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X					X			X	X
Centaurea diffusa Lam.	CEDI1	N		X	X			X	X	X	X	X	X	X	X		X			X	X	X	X															
Chrysanthemum leucanthemum L.	CHLE1	N				X																																
Chrysopsis fulcrata Greene	CHFU1	Y	X	X	X				X	X	X	X						X	X	X		X								X	X	X						
Chrysopsis villosa Pursh.	CHVI1	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X			X			X	X	X	X	X	X		X	X
Cichorium intybus L.	CIIN1	N																									X	X	X								X	X
Cirsium arvense (L.) Scop.	CIAR1	N				X	X	X					X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Cirsium undulatum (Nutt.) Spreng.	CIUN1	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X												X						
Circium vulgare (Savi) Ten.	CIVU1	N																			X		X															
Conyza canadensis (L.) Cronq.	COCA1	Y																				X	X		X		X	X	X									
Crepis occidentalis Nutt.	CROC1	Y																	X																			
Erigeron divergens T. & G.	ERDI1	Y			X	X	X	X		X		X	X	X	X	X	X		X			X	X	X					X	X	X						X	
Erigeron flagellaris Gray	ERFL1	Y	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X		X			X				X	X	X
Erigeron sp.	ERI1						X																															
Gaillardia aristata Pursh.	GAAR1	Y	X	X	X			X	X	X	X																											
Grindelia squarrosa (Pursh.) Dun.	GRSQ1	Y										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X			
Gutierrezia sarothrae (Pursh.) Britt. & Rusby	GUSA1	Y				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X				X	X	X	X	X	X	X			
Helianthus annuus L.	HEAN1	Y												X					X	X				X														
Helianthus petiolaris Nutt.	HEPE1	Y		X				X									X			X			X			X						X						
Helianthus pumilus Nutt.	HEPU1	Y	X	X	X	X	X	X				X	X	X	X	X		X	X					X			X											
Helianthus rigidus (Cass.) Desf. ssp. subrhomboides (Rydb.) Heiser	HERI1	Y			X																																	
Helianthus sp.	HEL1							X						X			X		X																			
Hymenopappus filifolius Hook.	HYFI1	Y				X						X		X				X																				
Iva axillaris Pursh	IVAX1	Y																								X												
Kuhnia chlorolepis Woot. & Standl.	KUCH1	Y												X	X			X		X									X	X	X	X	X	X	X			
Kuhnia eupatorioides L.	KUEU1	Y										X	X	X	X	X	X		X	X											X	X		X	X			
Kuhnia sp.	KUH1															X			X												X							
Lactuca oblongifolia Nutt.	LAOB1	Y																				X																
Lactuca serriola L.	LASE1	N	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X			X		X	X
Liatris punctata Hook.	LIPU1	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X							X			X	X	X		X	X			
Microseris cuspidata (Pursh.) Sch. Bip.	MICU1	Y		X	X		X	X		X	X		X	X		X	X		X	X								X										
Picradeniopsis oppositifolia (Nutt.) Rydb.	PIOP1	Y																	X	X																		

4/30/97 TABLE3 XLS
1993 and 1994 species richness based on belt transect and production plot data combined 1995 species richness based on belt transect and point-intercept data combined

TABLE 3. (cont.)

SCIENTIFIC NAME	SPEC. CODE	NATIVE	Xeric Sites TR01 93	TR01 94	TR01 95	TR06 93	TR06 94	TR06 95	TR12 93	TR12 94	TR12 95	Mesic Sites TR02 93	TR02 94	TR02 95	TR04 93	TR04 94	TR04 95	TR11 93	TR11 94	TR11 95	Riparian Sites TR03 93	TR03 94	TR03 95	TR05 93	TR05 94	TR05 95	TR10 93	TR10 94	TR10 95	Reclaimed Sites TR07 93	TR07 94	TR07 95	TR08 93	TR08 94	TR08 95	TR09 93	TR09 94	TR09 95
Ratibida columnifera (Nutt.) Woot. & Standl.	RACO1	Y	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		X		X	X						
Scorzonera laciniata L.	SCLA1	N		X			X	X	X	X	X	X	X	X	X	X	X		X	X			X			X		X	X		X			X			X	X
Senecio integerrimus Nutt.	SEIN1	Y								X			X			X	X		X												X							
Senecio plattensis Nutt.	SEPL1	Y		X	X			X	X	X	X		X	X		X			X	X		X												X	X			
Senecio spartioides T. & G.	SESP1	Y					X	X	X	X	X	X	X	X				X	X	X										X	X		X	X	X			
Senecio tridenticulatus Rydb.	SETR1	Y																													X	X		X				
Solidago gigantea Ait.	SOGI1	Y																					X															
Solidago missouriensis Nutt.	SOMI1	Y	X	X											X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
Solidago mollis Bart.	SOMO1	Y	X		X				X	X	X				X						X	X	X	X	X		X	X										
Solidago nemoralis Ait.	SONE1	Y								X	X																											
Solidago rigida L.	SORI1	Y											X	X									X			X												
Solidago sp.	SOL2				X											X			X																			
Sonchus arvensis L. ssp. ugilnosus (Bieb.) Nyman	SOAR2	N																					X															
Sonchus asper (L.) Hill	SOAS1	N																					X			X			X									
Sonchus sp.	SON1																												X									
Stephanomeria pauciflora (Torr.) A. Nels.	STPA1	Y																					X						X									
Taraxacum laevigatum (Willd.) DC.	TALA1	N												X																								
Taraxacum officinale Weber	TAOF1	N		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X			X				X	X	X
Taraxacum sp.	TAR1																																		X			
Thelesperma megapotanicum (Spreng.) O. Ktze.	THME1	Y			X		X	X						X											X													
Townsendia grandiflora (Nutt.)	TOGR1	Y					X																															
Townsendia hookeri Beaman	TOHO1	Y		X	X																																	
Tragopogon dubius Scop.	TRDU1	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Xanthium strumarium L.	XAST1	Y																								X	X											
BORAGINACEAE																																						
Cynoglossum officinale L.	CYOF1	N																					X		X	X	X	X	X									
Lappula redowskii (Hornem.) Greene	LARE1	Y			X		X	X					X	X		X	X		X	X																		
Lithospermum incisum Lehm.	LIIN1	Y				X	X	X	X		X		X					X	X	X																		
Mertensia lanceolata (Pursh.) A. DC.	MELA1	Y		X	X		X			X	X																	X	X									
Onosmodium molle Michx.	ONMO1	Y										X	X	X							X	X	X															
BRASSICACEAE																																						
Alyssum alyssoides (L.) L.	ALAL1	N			X																		X												X			
Alyssum minus (L.) Rothmaler	ALMI1	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
Arabis fendleri (Wats.) Greene	ARFE3	Y																	X																			
Arabis glabra (L.) Bernh.	ARGL1	N		X	X											X	X						X															
Arabis hirsuta (L.) Scop. var. pynocarpa (Hopkins) Rollins	ARHI1	Y			X																																	

4/30/97 TABLE3.XLS

1993 and 1994 species richness based on belt transect and production plot data combined 1995 species richness based on belt transect and point intercept data combined

TABLE 3. (cont.)

			Xeric Sites									Mesic Sites									Riparian Sites									Reclaimed Sites								
	SPEC.	NATIVE	TR01	TR01	TR01	TR06	TR06	TR06	TR12	TR12	TR12	TR02	TR02	TR02	TR04	TR04	TR04	TR11	TR11	TR11	TR03	TR03	TR03	TR05	TR05	TR05	TR10	TR10	TR10	TR07	TR07	TR07	TR08	TR08	TR08	TR09	TR09	TR09
SCIENTIFIC NAME	CODE		93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95
Arabis sp.	ARA1			X									X																									
Barbarea orthoceras Ledeb.	BAOR1	N									X										X	X	X	X	X	X												
BRASSICACEAE sp.	BR1				X		X							X					X																			
Cardaria chalepensis (L.) Hand-Mazz.	CACH1	N																										X										
Camelina microcarpa Andrz.	CAMI1	N	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X				X	X		X	X		X			X	X
Descurainia pinnata (Walt.) Britt.	DEPI1	Y		X	X	X	X	X		X	X		X	X		X	X		X	X	X	X	X	X				X	X		X	X			X		X	X
Descurainia richardsonii (Sweet) Schultz	DERI1	Y					X	X								X	X		X	X			X						X			X						X
Descurainia sophia (L.) Webb	DESO1	N				X	X											X					X															
Descurainia sp.	DES1															X																						
Draba nemorosa L.	DRNE1	Y		X																		X																
Draba reptans (Lam.) Fern.	DRRE1	Y		X	X		X	X		X	X		X	X		X	X		X	X																		
Erysimum asperum (Nutt.) DC.	ERAS1	Y	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X				X							X							
Erysimum repandum L.	ERRE1	N														X	X																					
Lepidium sp.	LEP1									X						X			X	X			X					X										
Lepidium densiflorum Schrad.	LEDE1	Y									X			X		X	X						X						X									
Lesquerella montana (A. Gray) Wats.	LEMO1	Y	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X																	
Nasturtium officinale R. Br.	NAOF1	N																			X	X	X															
Physaria vitulifera Rydb.	PHVI1	Y																						X														
Sisymbrium altissimum L.	SIAL1	N				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X									
Thlaspi arvense L.	THAR1	N												X		X	X				X	X	X		X	X	X	X	X									
CACTACEAE																																						
Coryphantha missouriensis (Sweet) Britt. & Rose	COMI1	Y	X	X	X	X	X	X					X	X		X	X		X	X																		
Echinocereus viridiflorus Engelm.	ECVI1	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X									X									
Opuntia fragilis (Nutt.) Haw.	OPFR1	Y		X	X							X	X	X	X	X	X	X	X	X	X	X	X					X	X									
Opuntia humifusa (Raf.) Raf.	OPHU1	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X			X	X	X	X
Opuntia polycantha Haw.	OPPO1	Y													X																							
Pediocactus simpsonii (Engelm.) Britt. & Rose	PESI1	Y					X	X		X			X																									
CAMPANULACEAE																																						
Campanula rotundifolia L.	CARO1	Y																					X															
Lobelia siphilitica L.	LOSI1	Y																					X						X									
Triodanis leptocarpa (Nutt.) Nieuw.	TRLE1	Y												X																								
Triodanis sp.	TRI2												X			X																						
CAPRIFOLIACEAE																																						
Symphoricarpos occidentalis Hook.	SYOC1	Y																			X	X	X	X	X	X	X	X	X									
CARYOPHYLLACEAE																																						
Arenaria fendleri A. Gray	ARFE2	Y	X	X	X				X	X	X																											

1993 and 1994 species richness based on belt transect and production plot data combined. 1995 species richness based on belt transect and point-intercept data combined.

TABLE 3. (cont.)

SCIENTIFIC NAME	SPEC. CODE	NATIVE	Xeric Sites									Mesic Sites									Riparian Sites									Reclaimed Sites								
			TR01 93	TR01 94	TR01 95	TR06 93	TR06 94	TR06 95	TR12 93	TR12 94	TR12 95	TR02 93	TR02 94	TR02 95	TR04 93	TR04 94	TR04 95	TR11 93	TR11 94	TR11 95	TR03 93	TR03 94	TR03 95	TR05 93	TR05 94	TR05 95	TR10 93	TR10 94	TR10 95	TR07 93	TR07 94	TR07 95	TR08 93	TR08 94	TR08 95	TR09 93	TR09 94	TR09 95
Cerastium arvense L.	CEAR1	Y																				X	X															
Paronychia jamesii T. & G.James	PAJA1	Y	X	X	X	X	X	X	X	X	X		X																									
Silene antirrhina L.	SIAN1	Y		X	X					X			X	X		X	X		X	X																		
Silene drummondii Hook.	SIDR1	Y	X	X	X	X	X	X	X	X	X			X					X																			
Stellaria longifolia Muhl. ex. Willd.	STLO1	Y	X																																			
Vaccaria pyramidata Medic.	VAPY1	N																																	X			
CHENOPODIACEAE																																						
Chenopodiaceae sp.	CH1							X						X																								
Chenopodium album L.	CHAL1	N						X																														
Chenopodium leptophyllum Nutt. ex Moq.	CHLE2	Y				X	X	X			X	X	X	X	X	X	X	X	X	X																		
CLUSIACEAE																																						
Hypericum perforatum L.	HYPE1	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
COMMELINACEAE																																						
Tradescantia occidentalis (Britt.) Smyth	TROC1	Y			X			X					X	X		X	X		X	X																		
CONVOLVULACEAE																																						
Calystegium sepium (L.) R. Br. ssp angulata Brummitt	CASE1	Y																						X														
Convolvulus arvensis L.	COAR1	N						X				X	X	X						X		X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X
Evolvulus nuttallianus R. & S.	EVNU1	Y				X		X				X	X	X	X		X	X	X	X																		
CRASSULACEAE																																						
Sedum lanceolatum Torr.	SELA1	Y			X																																	
CYPERACEAE																																						
Carex brevior (Dew.) Mack. ex Lunell.	CABR1	Y																					X			X			X									
Carex eleocharis Bailey	CAEL1	Y	X			X			X	X		X	X	X	X	X	X	X										X	X									
Carex filifolia Nutt.	CAFI1	Y					X	X																														
Carex heliophila Mack.	CAHE1	Y		X	X		X	X		X	X		X	X		X			X	X																		
Carex interior Bailey	CAIN1	Y																	X																			
Carex lanuginosa Michx.	CALA1	Y																				X	X		X													
Carex nebraskensis Dew.	CANE1	Y																			X	X	X	X	X	X	X	X	X									
Carex oreocharis Holm.	CAOR1	Y							X	X			X					X																				
Carex praegracilis W. Boott.	CAPR1	Y																			X	X	X	X		X			X									
Carex rostrata Stokes ex Willd.	CARO2	Y																				X	X															
Carex simulata Mack.	CASI1	Y																				X	X															
Carex stipata Muhl.	CAST1	Y																										X	X									
Carex sp.	CAR1															X							X		X			X	X									
Eleocharis acicularis (L.) R. & S.	ELAC1	Y																			X			X			X											
Eleocharis macrostachya Britt.	ELMA1	Y																					X		X	X			X									

4/30/97 TABLE3.XLS
1993 and 1994 species richness based on belt transect and production plot data combined. 1995 species richness based on belt transect and point-intercept data combined.

TABLE 3. (cont.)

SCIENTIFIC NAME	SPEC-CODE	NATIVE	Xeric Sites TR01 93	Xeric TR01 94	Xeric TR01 95	Xeric TR06 93	Xeric TR06 94	Xeric TR06 95	Xeric TR12 93	Xeric TR12 94	Xeric TR12 95	Mesic Sites TR02 93	Mesic TR02 94	Mesic TR02 95	Mesic TR04 93	Mesic TR04 94	Mesic TR04 95	Mesic TR11 93	Mesic TR11 94	Mesic TR11 95	Riparian Sites TR03 93	Riparian TR03 94	Riparian TR03 95	Riparian TR05 93	Riparian TR05 94	Riparian TR05 95	Riparian TR10 93	Riparian TR10 94	Riparian TR10 95	Reclaimed Sites TR07 93	Reclaimed TR07 94	Reclaimed TR07 95	Reclaimed TR08 93	Reclaimed TR08 94	Reclaimed TR08 95	Reclaimed TR09 93	Reclaimed TR09 94	Reclaimed TR09 95
Eleocharis parvula (R. & S.) Link ex Bluff	ELPA1	Y																				X			X			X										
Scirpus americanus Pers.	SCAM1	Y																						X	X	X		X										
Scirpus pallidus (Britt.) Fern	SCPA1	Y																			X	X	X		X		X	X	X									
Scirpus validus Vahl.	SCVA1	Y																				X	X	X	X	X												
Scirpus sp.	SCI1																									X												
EQUISETACEAE																																						
Equisetum arvense L.	EQAR1	Y																				X	X		X	X		X	X									
Equisetum hyemale L.	EQHY1	Y																			X	X					X											
Equisetum laevigatum A. Br.	EQLA1	Y																				X	X					X	X									
EUPHORBIACEAE																																						
Euphorbia dentata Michx.	EUDE1	Y																	X																			
Euphorbia marginata Pursh	EUMA1	Y												X						X																		
Euphorbia robusta (Engelm.) Small	EURO1	Y								X	X		X	X						X																		
Euphorbia serpyllifolia Pers.	EUSE1	Y																										X										
Euphorbia spathulata Lam.	EUSP1	Y											X	X		X	X		X	X																		
Euphorbia sp.	EUP1								X																													
FABACEAE																																						
Fabaceae sp.	FA1							X																														
Amorpha fruticosa L.	AMFR1	Y																			X	X	X	X	X	X	X	X	X									
Astragalus agrestis Dougl. ex G. Don	ASAG1	Y	X	X	X		X	X					X		X	X	X		X									X										
Astragalus crassicarpus Nutt.	ASCR1	Y								X			X	X		X	X																	X				
Astragalus drummondii Dougl. ex Hook.	ASDR1	Y													X	X	X																X					
Astragalus flexuosus (Hook.)G. Don	ASFL1	Y	X			X	X	X				X	X	X												X			X		X	X			X			
Astragalus missouriensis Nutt.	ASMI1	Y		X																																		
Astragalus parryi Gray	ASPA1	Y																																X	X			
Astragalus sericoleucus Gray	ASSE1	Y					X	X					X																									
Astragalus shortianus Nutt. ex T.&G.	ASSH1	Y	X	X		X	X	X	X	X	X		X	X		X			X	X	X																	
Astragalus sp.	AST2			X	X			X					X																	X		X			X			
Dalea candida Willd.	DACA1	Y										X		X			X	X	X	X														X	X			
Dalea purpurea Vent	DAPU1	Y	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X							X											
Glycyrrhiza lepidota Pursh.	GLLE1	Y																			X	X	X	X	X	X	X	X	X									
Lathyrus eucosmus Butters and St. John	LAEU1	Y																			X	X			X	X	X		X	X								
Lupinus argenteus Pursh.	LUAR1	Y																			X	X	X															
Melilotus alba Medic.	MEAL1	N																			X		X	X	X	X	X			X			X	X	X			
Melilotus officinalis (L.) Pall.	MEOF1	N													X									X	X	X				X	X	X	X	X	X	X	X	X
Melilotus sp.	MEL1																																					

4/30/97 TABLE3.XLS
1993 and 1994 species richness based on belt transect and production plot data combined 1995 species richness based on belt transect and point-intercept data combined.

TABLE 3. (cont.)

			Xeric Sites									Mesic Sites									Riparian Sites									Reclaimed Sites								
	SPEC-	NATIVE	TR01	TR01	TR01	TR06	TR06	TR06	TR12	TR12	TR12	TR02	TR02	TR02	TR04	TR04	TR04	TR11	TR11	TR11	TR03	TR03	TR03	TR05	TR05	TR05	TR10	TR10	TR10	TR07	TR07	TR07	TR08	TR08	TR08	TR09	TR09	TR09
SCIENTIFIC NAME	CODE		93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95
Medicago lupulina L.	MELU1	N																			X	X	X		X	X	X	X	X		X	X	X	X	X			
Medicago sativa L.	MESA1	N																														X	X	X	X	X	X	X
Oxytropis lambertii Pursh.	OXLA1	Y	X	X	X	X	X	X	X	X	X		X	X						X			X															
Psoralea tenuiflora Pursh.	PSTE1	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X			X		X				
Thermopsis rhombifolia var. divaricarpa Nels.	THRH1	Y																			X	X	X	X	X	X	X	X	X									
Trifolium sp.	TRI1																		X										X									
Vicia americana Muhl. ex Willd.	VIAM1	Y	X									X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X			X	X	X	X		X	X
GERANIACEAE																																						
Erodium cicutarium (L.) L'Her.	ERCI1	N											X	X		X	X			X	X	X	X	X														
Geranium caespitosum James	GECA1	Y																			X	X	X				X	X	X									
GROSSULARIACEAE																																						
Ribes odoratum Wendl.	RIOD1	Y																				X					X	X	X									
HYDROPHYLLACEAE																																						
Phacelia heterophylla Pursh.	PHHE1	Y	X	X		X	X	X	X	X	X		X					X	X	X																		
IRIDACEAE																																						
Sisyrinchium montanum Greene	SIMO1	Y																										X										
JUNCACEAE																																						
Juncus balticus Willd.	JUBA1	Y																			X	X	X	X	X	X	X	X	X									
Juncus dudleyi Wieg.	JUDU1	Y			X															X	X	X	X			X	X	X	X									
Juncus ensifolius Wikst. var. montanus (Englm.) C. L. Hitchc.	JUEN1	Y																					X			X			X									
Juncus interior Wieg.	JUIN1	Y																								X			X									
Juncus nodosus L.	JUNO1	Y																			X																	
Juncus torreyi Cov.	JUTO1	Y																			X	X			X	X	X		X									
LAMIACEAE																																						
Hedeoma hispidum Pursh	HEHI1	Y	X												X			X																				
Lycopus americanum Muhl. ex Barton	LYAM1	Y																					X					X	X									
Mentha arvensis L.	MEAR1	Y																			X	X	X		X	X	X	X	X									
Monarda fistulosa L.	MOFI1	Y																			X	X	X				X	X	X									
Nepeta cataria L.	NECA1	N												X							X	X	X			X	X	X	X									
Prunella vulgaris L.	PRVU1	Y																			X	X	X				X	X	X									
Scutellaria brittonii Porter	SCBR1	Y																	X																			
Stachys palustris L.	STPA2	Y																			X	X	X					X	X									
LEMNACEAE																																						
Lemna minor L.	LEMI1	Y																			X	X	X															
LILIACEAE																																						
Allium textile A. Nels. & Macbr.	ALTE1	Y	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X			X				X		X									

4/30/97 TABLE3.XLS
1993 and 1994 species richness based on belt transect and production plot data combined 1995 species richness based on belt transect and point-intercept data combined.

TABLE 3. (cont.)

SCIENTIFIC NAME	SPEC. CODE	NATIVE	Xeric Sites									Mesic Sites									Riparian Sites									Reclaimed Sites								
			TR01 93	TR01 94	TR01 95	TR06 93	TR06 94	TR06 95	TR12 93	TR12 94	TR12 95	TR02 93	TR02 94	TR02 95	TR04 93	TR04 94	TR04 95	TR11 93	TR11 94	TR11 95	TR03 93	TR03 94	TR03 95	TR05 93	TR05 94	TR05 95	TR10 93	TR10 94	TR10 95	TR07 93	TR07 94	TR07 95	TR08 93	TR08 94	TR08 95	TR09 93	TR09 94	TR09 95
Asparagus officinalis L.	ASOF1	N																									X	X	X									
Calochortus gunnisonii S. Wats.	CAGU1	Y						X			X						X	X		X			X						X									
Leucocrinum montanum Nutt.	LEMO2	Y	X				X	X		X	X		X	X			X		X	X																		
LINACEAE																																						
Linum perenne L. var. lewisii (Pursh.) Eat. & Wright	LIPE1	Y				X	X	X				X	X	X	X	X	X				X	X	X					X	X									
MALVACEAE																																						
Sphaeralcea coccinea (Pursh.) Rydb.	SPCO1	Y					X	X		X		X	X	X	X	X	X	X	X	X				X		X			X									
NYCTAGINACEAE																																						
Mirabilis linearis (Pursh.) Heimerl	MILI1	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X														
ONAGRACEAE																																						
Calylophus serrulatus (Nutt.) Raven	CASE2	Y	X	X	X				X	X	X																											
Epilobium ciliatum Raf.	EPCI1	Y																			X	X	X	X		X	X	X	X									
Epilobium paniculatum Nutt.	EPPA1	Y										X					X						X	X	X			X	X									
Epilobium sp.	EPI1																						X															
Gaura coccinea Pursh.	GACO1	Y	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X			X	X														
Gaura parviflora Dougl.	GAPA1	Y																						X	X		X	X	X									
Oenothera biennis L.	OEBI1	Y																			X	X	X	X	X	X	X	X	X									
Oenothera brachycarpa Gray	OEBR1	Y					X	X								X	X																					
Oenothera coronopifolia T. & G.	OECO1	Y	X						X	X																												
Oenothera sp.	OEN1									X																												
OROBANCHACEAE																																						
Orobanche fasciculata Nutt.	ORFA1	Y		X	X		X	X		X	X						X		X	X											X	X						
OXALIDACEAE																																						
Oxalis dillenii Jacq.	OXDI1	N																			X	X	X				X											
PLANTAGINACE																																						
Plantago lanceolata L.	PLLA1	N													X	X					X	X	X					X										
Plantago major L.	PLMA1	N																					X														X	
Plantago patagonica Jacq.	PLPA1	Y					X	X							X		X			X																		
POACEAE																																						
Agropyron caninum (L.) Beauv.	AGCA1	Y																									X	X										
Agropyron cristatum (L.) Gaertn.	AGCR1	N																			X						X			X	X	X	X	X	X	X	X	X
Agropyron intermedium (Host) Beauv.	AGIN1	N													X	X					X			X			X		X	X	X	X	X	X	X	X	X	X
Agropyron repens (L.) Beauv.	AGRE1	N																			X	X	X	X	X	X	X	X	X									
Agropyron smithii Rydb.	AGSM1	Y			X	X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X		X
Agrostis stolonifera L.	AGST1	N																			X	X	X	X	X	X	X	X	X									
Andropogon gerardii Vitman	ANGE1	Y	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X		X															

1993 and 1994 species richness based on belt transect and production plot data combined. 1995 species richness based on belt transect and point-intercept data combined.

TABLE 3. (cont.)

			Xeric Sites									Mesic Sites									Riparian Sites									Reclaimed Sites								
	SPEC.	NATIVE	TR01	TR01	TR01	TR06	TR06	TR06	TR12	TR12	TR12	TR02	TR02	TR02	TR04	TR04	TR04	TR11	TR11	TR11	TR03	TR03	TR03	TR05	TR05	TR05	TR10	TR10	TR10	TR07	TR07	TR07	TR08	TR08	TR08	TR09	TR09	TR09
SCIENTIFIC NAME	CODE		93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95
Andropogon scoparius Michx.	ANSC1	Y	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X																		
Aristida purpurea Nutt. var. longiseta (Steud.) Vasey	ARFE1	Y		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X										X				X				
Aristida purpurea Nutt. var. robusta (Merrill) Holmgren & Holmgren	ARLO1	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X			X			X	X	X	X	X	X			
Aristida sp.	ARI1						X									X															X							
Bouteloua curtipendula (Michx.) Torr.	BOCU1	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																		
Bouteloua gracilis (H. B. K.) Lag ex Griffiths	BOGR1	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X			X	X	X									
Bouteloua hirsuta Lag	BOHI1	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X									X						X			
Bouteloua sp.	BOU1															X																						
Bromus inermis Leyss.	BRIN1	N										X	X	X							X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bromus japonicus Thunb. ex Murr.	BRJA1	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X	X	X	X
Bromus tectorum L.	BRTE1	N	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X	X	X		X	X			X		X									
Buchloe dactyloides (Nutt.) Engelm.	BUDA1	Y		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X			X			X											
Dactylis glomerata L.	DAGL1	N																			X	X	X	X	X	X												
Echinochloa crusgallii (L.) Beauv.	ECCR1	N																						X		X												
Elymus canadensis L.	ELCA1	Y																			X	X	X	X	X	X	X	X	X									
Festuca octoflora Walt.	FEOC1	Y																		X																		
Festuca pratensis Huds.	FEPR1	Y																			X	X	X	X	X	X												
Glyceria grandis S. Wats. ex A. Gray	GLGR1	Y																						X		X												
Glyceria striata (Lam.) Hitchc.	GLST1	Y																					X						X									
Hordeum jubatum L.	HOJU1	Y													X		X		X		X		X	X	X	X												
Koeleria pyramidata (Lam.) Beauv.	KOPY1	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X			X	X	X	X								
Leersia oryzoides (L.) Sw.	LEOR1	Y																					X			X												
Muhlenbergia filiformis (Thurb.) Rydb.	MUFI1	Y																											X									
Muhlenbergia montana (Nutt.) Hitchc.	MUMO1	Y	X	X	X				X	X	X				X	X				X																		
Muhlenbergia racemosa (Michx.) B. S. P.	MURA1	Y																							X													
Muhlenbergia torreyi (Kunth) Hitchc. ex Bush	MUTO1	Y	X																																			
Muhlenbergia wrightii Vasey	MUWR1	Y											X		X		X	X	X	X			X															
Panicum capillare L.	PACA1	Y																								X												
Panicum virgatum L.	PAVI1	Y																						X			X	X	X									
Phleum pratense L.	PHPR1	N																			X	X	X	X	X	X												
Poa canbyi (Scribn.) Piper	POCA1	Y					X	X																														
Poa compressa L.	POCO1	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X						X
Poa palustris L.	POPA1	N																					X															
Poa pratensis L.	POPR1	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X
Poaceae sp.	PO1													X									X	X		X			X									
Schedonnardus paniculatus (Nutt.) Trel.	SCPA2	N																						X														

TABLE 3. (cont.)

SCIENTIFIC NAME	SPEC-CODE	NATIVE	Xeric Sites									Mesic Sites									Riparian Sites									Reclaimed Sites								
			TR01 93	TR01 94	TR01 95	TR06 93	TR06 94	TR06 95	TR12 93	TR12 94	TR12 95	TR02 93	TR02 94	TR02 95	TR04 93	TR04 94	TR04 95	TR11 93	TR11 94	TR11 95	TR03 93	TR03 94	TR03 95	TR05 93	TR05 94	TR05 95	TR10 93	TR10 94	TR10 95	TR07 93	TR07 94	TR07 95	TR08 93	TR08 94	TR08 95	TR09 93	TR09 94	TR09 95
Sitanion hystrix (Nutt.) Sm.	SIHY1	Y	X	X	X	X	X	X	X	X	X	X	X	X	X			X		X	X			X				X											
Sorghastrum nutans (L.) Nash	SONU1	Y	X	X	X				X	X	X																												
Sporobolus asper (Michx.) Kunth	SPAS1	Y																								X													
Sporobolus cryptandrus (Torr.) A. Gray	SPCR1	Y										X	X								X				X	X													
Sporobolus heterolepis (A. Gray) A. Gray	SPHE1	Y		X	X					X									X	X																			
Sporobolus sp.	SPO1																												X										
Sphenopholis obtusata (Michx.) Scribn.	SPOB1	Y																				X	X																
Spartina pectinata Link	SPPE1	Y																			X	X	X																
Stipa comata Trin. & Rupr.	STCO1	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X				X		X										
Stipa sp.	STI1						X												X																				
Stipa neomexicana (Thur. ex Vasey.) Scribn.	STNE1	Y					X	X																															
Stipa robusta (Vasey) Scribn.	STRO1	Y																										X											
Stipa viridula Trin.	STVI1	Y	X	X								X	X	X	X	X	X	X	X	X	X	X	X	X			X		X										
Triticum aestivum L.	TRAE1	N		X												X																							
POLEMONIACEAE																																							
Collomia linearis Nutt.	COLI1	Y											X				X		X	X																			
Ipomopsis spicata (Nutt.) V. Grant	IPSP1	Y	X	X	X																																		
Microsteris gracilis (Hook.) Greene	MIGR1	Y														X	X																						
POLYGONACEAE																																							
Eriogonum alatum Torr.	ERAL1	Y	X	X	X	X	X	X	X	X	X	X	X	X				X			X																		
Eriogonum flavum Nutt.	ERFL2	Y	X																		X																		
Polygonum aviculare L.	POAV1	N				X									X												X												
Polygonum convolvulus L.	POCO2	N																			X		X						X										X
Polygonum lapathifolium L.	POLA1	N																			X	X	X	X	X														
Polygonum sawatchense Small	POSA1	Y						X						X		X	X				X		X			X													
Polygonum sp.	POL1													X																									
Rumex crispus L.	RUCR1	N																			X	X	X	X	X	X	X	X	X										
Rumex mexicanus Meisn.	RUME1	Y																				X	X		X	X		X	X										
Rumex obtusifolius L.	RUOB1	N																				X						X											
Rumex sp.	RUM1																									X													
PORTULACACEAE																																							
Talinum parviflorum Nutt.	TAPA1	Y	X	X	X			X			X																												
PRIMULACEAE																																							
Androsace occidentalis Pursh.	ANOC1	Y					X	X																															
Lysimachia ciliata L.	LYCI1	Y																									X												
RANUNCULACEAE																																							

1993 and 1994 species richness based on belt transect and production plot data combined 1995 species richness based on belt transect and point-intercept data combined

TABLE 3. (cont.)

			Xeric Sites									Mesic Sites									Riparian Sites									Reclaimed Sites								
SCIENTIFIC NAME	SPEC. CODE	NATIVE	TR01 93	TR01 94	TR01 95	TR06 93	TR06 94	TR06 95	TR12 93	TR12 94	TR12 95	TR02 93	TR02 94	TR02 95	TR04 93	TR04 94	TR04 95	TR11 93	TR11 94	TR11 95	TR03 93	TR03 94	TR03 95	TR05 93	TR05 94	TR05 95	TR10 93	TR10 94	TR10 95	TR07 93	TR07 94	TR07 95	TR08 93	TR08 94	TR08 95	TR09 93	TR09 94	TR09 95
Delphinium nuttallianum Pritz. ex Walpers	DENU1	Y																										X										
Delphinium virescens Nutt.	DEVI1	Y						X									X			X																		
Delphinium sp.	DEL1															X			X																			
Ranunculus macounii Britt.	RAMA1	Y																			X		X				X		X									
ROSACEAE																																						
Agrimonia striata Michx.	AGST2	Y																					X															
Crataegus erythropoda Ashe	CRER1	Y																			X	X	X				X											
Geum macrophyllum Willd.	GEMA1	Y																			X	X	X			X	X	X	X									
Geum sp.	GEU1																											X										
Potentilla fissa Nutt.	POFI1	Y			X					X	X																											
Potentilla gracilis Dougl. ex Hook.	POGR1	Y	X	X					X												X		X			X			X									
Potentilla hippiana Lehm.	POHI1	Y	X	X	X					X												X						X										
Prunus virginiana L.	PRVI1	Y																			X	X	X				X	X	X									
Rosa acicularis Lindl.	ROAC1	Y										X			X			X		X	X			X			X											
Rosa arkansana Porter	ROAR1	Y											X	X		X	X		X	X		X	X		X	X		X	X									
Rosa woodsii Lindl.	ROWO1	Y																			X	X	X		X	X	X	X	X									
RUBIACEAE																																						
Galium aparine L.	GAAP1	Y																					X			X			X									
Galium boreale L.	GABO1	Y																				X						X										
SALICACEAE																																						
Populus x acuminata Rydb.	POAC1	Y																			X	X																
Populus deltoides Marsh. var occidentalis Rydb.	PODE1	Y																			X	X	X	X	X	X	X	X	X									
Salix amygdaloides Anderss.	SAAM1	Y																			X	X	X	X	X	X	X	X	X									
Salix exigua Nutt. ssp. interior (Rowlee) Cronq.	SAEX1	Y																			X	X	X	X	X	X	X	X	X									
Salix lutea Nutt. var. ligulifolia Ball	SALU1	Y																				X																
SANTALACEAE																																						
Comandra umbellata (L.) Nutt.	COUM1	Y	X	X	X		X			X			X	X		X			X			X	X					X										
SCROPHULARIACEAE																																						
Castilleja integra A. Gray	CAIN2	Y	X																																			
Castilleja sessiliflora Pursh.	CASE3	Y		X	X					X																												
Linaria dalmatica (L.) Mill.	LIDA1	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X				X	X	X		X	X
Mimulus glabrata H. B. K. var. fremontii (Benth.) A. L. Grant	MIGL1	Y																					X															
Penstemon angustifolius Nutt.	PEAN1	Y								X			X																									
Penstemon secundiflorus Benth.	PESE1	Y					X	X						X					X	X																		
Penstemon virens Penn.	PEVI1	Y		X	X					X	X		X	X					X	X			X						X									
Scrophularia lanceolata Pursh.	SCLA2	Y																			X		X			X	X	X	X									

1993 and 1994 species richness based on belt transect and production plot data combined. 1995 species richness based on belt transect and point-intercept data combined.

TABLE 3. (cont.)

			Xeric Sites									Mesic Sites									Riparian Sites									Reclaimed Sites								
	SPEC.	NATIVE	TR01	TR01	TR01	TR06	TR06	TR06	TR12	TR12	TR12	TR02	TR02	TR02	TR04	TR04	TR04	TR11	TR11	TR11	TR03	TR03	TR03	TR05	TR05	TR05	TR10	TR10	TR10	TR07	TR07	TR07	TR08	TR08	TR08	TR09	TR09	TR09
SCIENTIFIC NAME	CODE		93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95	93	94	95
Verbascum blattaria L.	VEBL1	N				X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						X			
Verbascum thapsus L.	VETH1	N				X	X	X					X					X	X		X	X	X	X		X	X	X	X									
Veronica americana (Raf.) Schwein. ex Benth.	VEAM1	Y																				X	X		X		X	X	X									
Veronica anagallis-aquatica L.	VEAN1	N																			X	X	X	X				X	X									
Veronica peregrina L.	VEPE1	Y			X												X																					
SELAGINELLACEAE																																						
Selaginella densa Rydb.	SEDE1	Y																				X						X										
SOLANACEAE																																						
Physalis heterophylla Nees	PHHE2	Y	X			X			X									X					X															
Physalis virginiana P. Mill.	PHVI2	Y															X										X	X	X				X	X				
Physalis sp.	PHY1															X						X																
Quincula lobata (Torr.) Raf.	QULO1	Y																											X								X	X
TYPHACEAE																																						
Typha latifolia L.	TYLA1	Y													X	X					X	X	X	X	X	X	X	X	X									
VERBENACEAE																																						
Lippia cuneifolia (Torr.) Steud.	LICU1	Y																			X						X	X	X									
Verbena bracteata Lag. & Rodr.	VEBR1	Y														X								X	X													
Verbena hastata L.	VEHA1	Y																			X	X	X				X	X	X									
VIOLACEAE																																						
Hybanthus verticillatus (Ort.) Baill.	HYVE1	Y											X	X					X	X																		
Viola nephrophylla Greene	VINE1	Y									X										X	X	X					X	X									
Viola nuttallii Pursh.	VINU1	Y		X	X		X	X		X	X			X			X		X	X									X									
Viola sp.	VIO1																						X			X		X										
Species Richness by Site			76	88	90	69	89	98	68	91	83	75	107	108	75	95	97	76	106	110	119	121	157	93	79	90	104	113	130	32	42	46	25	41	41	16	27	29

4/30/97 TABLE3.XLS
1993 and 1994 species richness based on belt transect and production plot data combined 1995 species richness based on belt transect and point-intercept data combined

TABLE 4. SPECIES RICHNESS SUMMARY DATA FOR ECMP SITES AND COMMUNITIES - YEARS 1993, 1994, & 1995

	# Families			# Species			% Native			# Annuals			# Biennials			# Perennials		
Sample Site\Year	1993	1994	1995	1993	1994	1995	1993	1994	1995	1993	1994	1995	1993	1994	1995	1993	1994	1995
Xeric Community	29	31	36	105	133	134	80	84	83	14	19	21	0	2	2	90	111	111
TR01	22	24	26	76	88	90	87	84	86	6	12	11	0	1	0	70	75	79
TR06	20	25	28	68	89	98	72	80	80	11	14	17	0	1	2	57	74	79
TR12	20	23	23	68	91	83	81	84	81	8	11	13	0	0	0	60	79	70
Mean	21	24	26	71	89	90	80	83	82	8	12	14	0	1	1	62	76	76
Mesic Community	26	37	36	104	143	141	76	81	82	15	27	29	2	1	1	87	113	111
TR02	21	30	29	75	107	108	77	81	80	10	17	22	0	0	0	65	90	86
TR04	19	30	29	75	95	97	72	76	79	12	23	25	2	1	1	61	70	71
TR11	22	28	30	76	106	110	79	83	83	11	17	21	0	1	1	65	86	87
Mean	21	29	29	75	103	105	76	80	81	11	19	23	1	1	1	64	82	81
Riparian Community	38	40	40	161	163	196	71	74	73	24	21	31	6	3	7	131	137	156
TR03	30	36	38	119	121	157	68	73	71	16	15	26	3	1	4	100	104	126
TR05	22	22	22	93	79	90	65	66	66	16	12	15	4	4	4	73	63	70
TR10	30	37	33	104	113	130	71	73	75	12	14	20	2	2	3	90	96	105
Mean	27	32	31	105	104	126	68	71	71	15	14	20	3	2	4	88	88	100
Reclaimed Community	11	13	14	42	61	63	64	62	59	3	9	12	2	2	3	37	50	48
TR07	9	9	9	32	42	46	65	62	63	2	7	6	2	2	3	27	33	37
TR08	9	9	10	25	41	41	56	59	55	2	7	7	1	2	2	22	32	31
TR09	6	9	9	16	27	29	25	30	31	2	7	8	1	1	2	13	19	19
Mean	8	9	9	24	37	39	49	50	50	2	7	7	1	2	2	21	28	29

Community values based on all 3 sites combined.
Site values are the actual number of species from a site except where the column heading indicates otherwise.
Mean = average of 3 site values.

TABLE 4. (cont.)

Sample Site\Year	Growth Form: Forb 1993	Forb 1994	Forb 1995	Graminoid 1993	Graminoid 1994	Graminoid 1995	Cactus 1993	Cactus 1994	Cactus 1995	Shrub 1993	Shrub 1994	Shrub 1995	Vine 1993	Vine 1994	Vine 1995	Tree 1993	Tree 1994	Tree 1995
Xeric Community	78	99	103	22	27	24	3	5	5	2	2	2	0	0	0	0	0	0
TR01	54	62	65	18	21	20	3	4	4	1	1	1	0	0	0	0	0	0
TR06	47	64	73	17	20	20	3	4	4	1	1	1	0	0	0	0	0	0
TR12	48	66	63	18	22	18	2	3	2	0	0	0	0	0	0	0	0	0
Mean	50	64	67	18	21	19	3	4	3	1	1	1	0	0	0	0	0	0
Mesic Community	72	106	108	26	30	26	4	5	4	2	2	3	0	0	0	0	0	0
TR02	50	78	82	20	22	20	3	5	4	2	2	2	0	0	0	0	0	0
TR04	49	70	74	21	20	18	4	4	4	1	1	1	0	0	0	0	0	0
TR11	51	79	80	20	21	23	3	4	4	2	2	3	0	0	0	0	0	0
Mean	50	76	79	20	21	20	3	4	4	2	2	2	0	0	0	0	0	0
Riparian Community	104	108	129	41	39	52	2	2	3	8	8	7	1	1	1	5	5	4
TR03	72	80	108	34	26	37	2	2	2	6	8	6	0	0	0	5	5	4
TR05	55	48	53	31	24	30	0	0	0	5	5	5	0	0	0	2	2	2
TR10	65	77	84	26	23	32	1	2	3	7	7	7	1	1	1	4	3	3
Mean	64	68	82	30	24	33	1	1	2	6	7	6	0	0	0	4	3	3
Reclaimed Community	31	50	52	9	9	9	1	1	1	1	1	1	0	0	0	0	0	0
TR07	22	32	36	8	8	8	1	1	1	1	1	1	0	0	0	0	0	0
TR08	19	33	32	5	7	7	0	0	1	1	1	1	0	0	0	0	0	0
TR09	9	21	21	6	5	7	1	1	1	0	0	0	0	0	0	0	0	0
Mean	17	29	30	6	7	7	1	1	1	1	1	1	0	0	0	0	0	0

Community values based on all 3 sites combined.
Site values are the actual number of species from a site except where the column heading indicates otherwise.
Mean = average of 3 site values.

TABLE 4. (cont.)

	Type									Form								
	Dicots			Monocots			Pteridophytes			Herbaceous			Succulent			Woody		
Sample Site\Year	1993	1994	1995	1993	1994	1995	1993	1994	1995	1993	1994	1995	1993	1994	1995	1993	1994	1995
Xeric Community	80	103	105	25	30	29	0	0	0	100	126	126	3	5	6	2	2	2
TR01	56	66	68	20	22	22	0	0	0	72	83	84	3	4	5	1	1	1
TR06	49	66	73	19	23	25	0	0	0	64	84	93	3	4	4	1	1	1
TR12	49	67	62	19	24	21	0	0	0	66	88	81	2	3	2	0	0	0
Mean	51	66	68	19	23	23	0	0	0	67	85	86	3	4	4	1	1	1
Mesic Community	75	109	110	29	34	31	0	0	0	98	136	134	4	5	4	2	2	3
TR02	53	81	84	22	26	24	0	0	0	70	100	102	3	5	4	2	2	2
TR04	54	73	75	21	22	22	0	0	0	70	90	92	4	4	4	1	1	1
TR11	53	81	82	23	25	28	0	0	0	71	100	103	3	4	4	2	2	3
Mean	53	78	80	22	24	25	0	0	0	70	97	99	3	4	4	2	2	2
Riparian Community	115	117	137	45	42	57	1	4	2	145	147	181	2	2	3	14	14	12
TR03	83	90	114	35	27	41	1	4	2	106	106	145	2	2	2	11	13	10
TR05	61	54	59	32	24	30	0	1	1	86	72	83	0	0	0	7	7	7
TR10	75	85	93	28	25	35	1	3	2	91	100	116	1	2	3	12	11	11
Mean	73	76	89	32	25	35	1	3	2	94	93	115	1	1	2	10	10	9
Reclaimed Community	32	51	53	10	10	10	0	0	0	40	59	61	1	1	1	1	1	1
TR07	23	33	37	9	9	9	0	0	0	30	40	44	1	1	1	1	1	1
TR08	19	33	33	6	8	8	0	0	0	24	41	39	0	0	1	1	1	1
TR09	10	22	22	6	5	7	0	0	0	15	26	28	1	1	1	0	0	0
Mean	17	29	31	7	7	8	0	0	0	23	36	37	1	1	1	1	1	1

Community values based on all 3 sites combined.
Site values are the actual number of species from a site except where the column heading indicates otherwise.
Mean = average of 3 site values.

TABLE 5. PLANT SPECIES RESTRICTED TO SPECIFIC COMMUNITIES FROM 1993-1995 ECMP SITE DATA

COMMUNITY	SCIENTIFIC NAME	SPECIES CODE	NATIVE
MESIC GRASSLAND COMMUNITY (16 species)			88%
APIACEAE	Musineon divaricatum (Pursh.) Nutt. ex T. & G.	MUDI1	Y
ASTERACEAE	Crepis occidentalis Nutt.	CROC1	Y
ASTERACEAE	Picradeniopsis oppositifolia (Nutt.) Rydb.	PIOP1	Y
ASTERACEAE	Taraxacum laevigatum (Willd.) DC.	TALA1	N
BRASSICACEAE	Arabis fendleri (S. Wats.) Greene	ARFE3	Y
BRASSICACEAE	Erysimum repandum L.	ERRE1	N
CACTACEAE	Opuntia polyacantha Haw.	OPPO1	Y
CAMPANULACEAE	Triodanis leptocarpa (Nutt.) Nieuw.	TRLE1	Y
CYPERACEAE	Carex interior Bailey	CAIN1	Y
EUPHORBIACEAE	Euphorbia dentata Michx.	EUDE1	Y
EUPHORBIACEAE	Euphorbia marginata Pursh.	EUMA1	Y
EUPHORBIACEAE	Euphorbia spathulata Lam.	EUSP1	Y
LAMIACEAE	Scutellaria brittonii Porter	SCBR1	Y
POACEAE	Festuca octoflora Walt.	FEOC1	Y
POLEMONIACEAE	Collomia linearis Nutt.	COLI1	Y
POLEMONIACEAE	Microsteris gracilis (Hook.) Greene	MIGR1	Y
RECLAIMED GRASSLAND COMMUNITY (4 species)			50%
ASTERACEAE	Senecio tridenticulatus Rydb.	SETR1	Y
CARYOPHYLLACEAE	Vaccaria pyramidata Medic.	VAPY1	N
FABACEAE	Astragalus parryi Gray	ASPA1	Y
FABACEAE	Medicago sativa L.	MESA1	N
RIPARIAN COMMUNITY (113 species)			82%
ANACARDIACEAE	Toxicodendron rydbergii (Small ex Rydberg) Greene	TORY1	Y
APIACEAE	Cicuta maculata L.	CIMA1	Y
APIACEAE	Conium maculatum L.	COMA1	N
APIACEAE	Heracleum sphondylium L.	HESP1	Y
APOCYNACEAE	Apocynum cannabinum L.	APCA1	Y
ASCLEPIADACEAE	Asclepias incarnata L.	ASIN1	Y
ASTERACEAE	Arctium minus Bernh.	ARMI1	Y
ASTERACEAE	Aster hesperius A. Gray	ASHE1	Y
ASTERACEAE	Aster laevis L.	ASLA1	Y
ASTERACEAE	Aster occidentalis (Nutt.) T. & G.	ASOC1	Y
ASTERACEAE	Bidens frondosa L.	BIFR1	Y
ASTERACEAE	Cirsium vulgare (Savi) Ten.	CIVU1	N
ASTERACEAE	Conyza canadensis (L.) Cronq.	COCA1	Y
ASTERACEAE	Iva axillaris Pursh.	IVAX1	Y
ASTERACEAE	Lactuca oblongifolia Nutt.	LAOB1	Y
ASTERACEAE	Solidago gigantea Ait.	SOGI1	Y
ASTERACEAE	Sonchus arvensis L. ssp. uglinosus (Bieb.) Nyman	SOAR2	N
ASTERACEAE	Sonchus asper (L.) Hill	SOAS1	N
ASTERACEAE	Stephanomeria pauciflora (Torr.) A. Nels.	STPA1	Y
ASTERACEAE	Xanthium strumarium L.	XAST1	Y
BORAGINACEAE	Cynoglossum officinale L.	CYOF1	N
BRASSICACEAE	Cardaria chalepensis (L.) Hand-Mazz	CACH1	N
BRASSICACEAE	Nasturtium officinale R. Br.	NAOF1	N
BRASSICACEAE	Physaria vitulifera Rydb.	PHVI1	Y
CAMPANULACEAE	Campanula rotundifolia L.	CARO1	Y
CAMPANULACEAE	Lobelia siphilitica L.	LOSI1	Y
CAPRIFOLIACEAE	Symphoricarpos occidentalis Hook.	SYOC1	Y
CARYOPHYLLACEAE	Cerastium arvense L.	CEAR1	Y
CONVOLVULACEAE	Calystegia sepium (L.) R. Br. ssp. angulata Brummitt	CASE1	Y
CYPERACEAE	Carex brevior (Dew.) Mack. ex Lunell.	CABR1	Y
CYPERACEAE	Carex lanuginosa Michx.	CALA1	Y
CYPERACEAE	Carex nebraskensis Dew.	CANE1	Y

TABLE 5. (cont.)

COMMUNITY	SCIENTIFIC NAME	SPECIES CODE	NATIVE
CYPERACEAE	Carex praegracilis W. Boott.	CAPR1	Y
CYPERACEAE	Carex rostrata Stokes ex Willd.	CARO2	Y
CYPERACEAE	Carex simulata Mack.	CASI1	Y
CYPERACEAE	Carex stipata Muhl.	CAST1	Y
CYPERACEAE	Eleocharis acicularis (L.) R. & S.	ELAC1	Y
CYPERACEAE	Eleocharis macrostachya Britt.	ELMA1	Y
CYPERACEAE	Eleocharis parvula Link ex Boff. & Ringerbr.	ELPA1	Y
CYPERACEAE	Scirpus americana Pers.	SCAM1	Y
CYPERACEAE	Scirpus pallidus (Britt.) Fern	SCPA1	Y
CYPERACEAE	Scirpus validus Vahl.	SCVA1	Y
EQUISETACEAE	Equisetum arvense L.	EQAR1	Y
EQUISETACEAE	Equisetum hyemale L.	EQHY1	Y
EQUISETACEAE	Equisetum laevigatum A. Br.	EQLA1	Y
EUPHORBIACEAE	Euphorbia serpyllifolia Pers.	EUSE1	Y
FABACEAE	Amorpha fruticosa L.	AMFR1	Y
FABACEAE	Glycyrrhiza lepidota Pursh.	GLLE1	Y
FABACEAE	Lupinus argenteus Pursh.	LUAR1	Y
FABACEAE	Thermopsis rhombifolia var. divaricarpa (Nels.) Isely	THRH1	Y
GERANIACEAE	Geranium caespitosum James ssp. caespitosum James	GECA1	Y
GROSSULARIACEAE	Ribes odoratum Wendl.	RIOD1	Y
IRIDACEAE	Sisyrinchium montanum Greene	SIMO1	Y
JUNCACEAE	Juncus balticus Willd.	JUBA1	Y
JUNCACEAE	Juncus ensifolius Wikst. var. montanus (Englm.) C. L. Hitchc.	JUEN1	Y
JUNCACEAE	Juncus interior Wieg.	JUIN1	Y
JUNCACEAE	Juncus nodosus L.	JUNO1	Y
LAMIACEAE	Lycopus americanus Muhl. ex Barton	LYAM1	Y
LAMIACEAE	Mentha arvensis L.	MEAR1	Y
LAMIACEAE	Monarda fistulosa L.	MOFI1	Y
LAMIACEAE	Prunella vulgaris L.	PRVU1	Y
LEMNACEAE	Lemna minor L.	LEMI1	Y
LILIACEAE	Asparagus officinalis L.	ASOF1	N
ONAGRACEAE	Epilobium ciliatum Raf.	EPCI1	Y
ONAGRACEAE	Gaura parviflora Dougl.	GAPA1	Y
ONAGRACEAE	Oenothera biennis L.	OEBI1	Y
OXALIDACEAE	Oxalis dillenii Jacq.	OXDI1	N
POACEAE	Agropyron caninum (L.) Beauv. ssp. majus (Vasey) C. L. Hitchc.	AGCA1	Y
POACEAE	Agropyron repens (L.) Beauv.	AGRE1	N
POACEAE	Agrostis stolonifera L.	AGST1	N
POACEAE	Dactylis glomerata L.	DAGL1	N
POACEAE	Echinochloa crusgallii (L.) Beauv.	ECCR1	N
POACEAE	Elymus canadensis L.	ELCA1	Y
POACEAE	Festuca pratensis Huds.	FEPR1	Y
POACEAE	Glyceria grandis S. Wats. ex A. Gray	GLGR1	Y
POACEAE	Glyceria striata (Lam.) Hitchc.	GLST1	Y
POACEAE	Leersia oryzoides (L.) Sw.	LEOR1	Y
POACEAE	Muhlenbergia filiformis (Thurb.) Rydb.	MUFI1	Y
POACEAE	Muhlenbergia racemosa (Michx.) B. S. P.	MURA1	Y
POACEAE	Panicum capillare L.	PACA1	Y
POACEAE	Panicum virgatum L.	PAVI1	Y
POACEAE	Phleum pratense L.	PHPR1	N
POACEAE	Poa palustris L.	POPA1	N
POACEAE	Schedonnardus paniculatus (Nutt.) Trel.	SCPA2	N
POACEAE	Spartina pectinata Link	SPPE1	Y
POACEAE	Sphenopholis obtusata (Michx.) Scribn.	SPOB1	Y
POACEAE	Sporobolus asper (Michx.) Kunth	SPAS1	Y
POACEAE	Stipa robusta (Vasey) Scribn.	STRO1	Y
POLYGONACEAE	Polygonum lapathifolium L.	POLA1	N
POLYGONACEAE	Rumex crispus L.	RUCR1	N
POLYGONACEAE	Rumex mexicanus Meisn.	RUME1	Y

TABLE 5. (cont.)

COMMUNITY	SCIENTIFIC NAME	SPECIES CODE	NATIVE
POLYGONACEAE	Rumex obtusifolius L.	RUOB1	N
PRIMULACEAE	Lysimachia ciliata L.	LYCI1	Y
RANUNCULACEAE	Delphinium nuttalianum Pritz. ex Walpers	DENU1	Y
RANUNCULACEAE	*Ranunculus macounii* Britt.	RAMA1	Y
ROSACEAE	Agrimonia striata Michx.	AGST2	Y
ROSACEAE	Crataegus erythropoda Ashe	CRER1	Y
ROSACEAE	Geum macrophyllum Willd.	GEMA1	Y
ROSACEAE	Prunus virginiana L.	PRVI1	Y
ROSACEAE	Rosa woodsii Lindl.	ROWO1	Y
RUBIACEAE	Galium aparine L.	GAAP1	Y
RUBIACEAE	Galium boreale L.	GABO1	Y
SALICACEAE	Populus deltoides Marsh. var occidentalis Rydb.	PODE1	Y
SALICACEAE	Populus x acuminata Rydb.	POAC1	Y
SALICACEAE	Salix amygdaloides Anderss..	SAAM1	Y
SALICACEAE	Salix exigua Nutt. ssp. interior (Rowlee) Cronq.	SAEX1	Y
SALICACEAE	Salix lutea Nutt.	SALU1	Y
SCROPHULARIACEAE	Castilleja sessiliflora Pursh.	CASE3	Y
SCROPHULARIACEAE	Mimulus glabratus H. B. K. var. fremontii (Benth.) A. L. Grant	MIGL1	Y
SCROPHULARIACEAE	Scrophularia lanceolata Pursh.	SCLA2	Y
SCROPHULARIACEAE	Veronica americana (Raf.) Schwein. ex Benth.	VEAM1	Y
SCROPHULARIACEAE	Veronica anagallis-aquatica L.	VEAN1	N
SELAGINELLACEAE	Selaginella densa Rydb.	SEDE1	Y
VERBENACEAE	Verbena hastata L.	VEHA1	Y
XERIC MIXED GRASSLAND COMMUNITY (23 species)			**91%**
ASTERACEAE	Antennaria microphylla Rydb.	ANMI1	Y
ASTERACEAE	Chrysanthemum leucanthemum L.	CHLE1	N
ASTERACEAE	Gaillardia aristata Pursh.	GAAR1	Y
ASTERACEAE	Helianthus rigidus (Cass.) Desf. ssp. subrhomboideus (Rydb.) Heiser	HERI1	Y
ASTERACEAE	Solidago nemoralis Ait.	SONE1	Y
ASTERACEAE	Townsendia grandiflora (Nutt.)	TOGR1	Y
ASTERACEAE	Townsendia hookeri Beaman	TOHO1	Y
BRASSICACEAE	Arabis hirsuta (L.) Scop. var. pynocarpa (Hopkins) Rollins	ARHI1	Y
CARYOPHYLLACEAE	Arenaria fendleri A. Gray	ARFE2	Y
CARYOPHYLLACEAE	*Stellaria longifolia* Muhl. ex Willd.	STLO1	Y
CHENOPODIACEAE	Chenopodium album L.	CHAL1	N
CRASSULACEAE	Sedum lanceolatum Torr.	SELA1	Y
CYPERACEAE	Carex filifolia Nutt.	CAFI1	Y
FABACEAE	Astragalus missouriensis Nutt.	ASMI1	Y
ONAGRACEAE	Calylophus serrulatus (Nutt.) Raven	CASE2	Y
POACEAE	Muhlenbergia torreyi (Kunth) Hitchc. ex Bush	MUTO1	Y
POACEAE	Poa canbyi (Scribn.) Piper	POCA1	Y
POACEAE	Sorghastrum nutans (L.) Nash	SONU1	Y
POACEAE	Stipa neomexicana (Thur.) Scribn.	STNE1	Y
POLEMONIACEAE	Ipomopsis spicata (Nutt.) V. Grant	IPSP1	Y
PORTULACACEAE	Talinum parviflorum Nutt.	TAPA1	Y
PRIMULACEAE	Androsace occidentalis Pursh.	ANOC1	Y
ROSACEAE	Potentilla fissa Nutt.	POFI1	Y

Note: Those species identified only to genus or family which only occurred in one community were not included in this list.

TABLE 6. WOODY STEM AND CACTUS DENSITIES AT ECMP SITES (1993-1995)

	Cactus Density (cacti/m^2)				Woody Stem Density (stems/m^2)			
Site	1993	1994	1995	3 yr. mean	1993	1994	1995	3 yr. mean
Xeric Mixed Grassland	0.600	0.650	1.060	0.770	0.050	0.040	0.080	0.057
TR01	0.520	0.790	1.720	1.010	0.004	0.002	0.002	0.003
TR06	0.190	0.210	0.240	0.213	0.160	0.110	0.240	0.170
TR12	1.090	0.950	1.210	1.083	0.000	0.000	0.000	0.000
Mesic Mixed Grassland	0.340	0.320	0.360	0.340	0.700	0.860	1.150	0.903
TR02	0.430	0.250	0.470	0.383	1.240	1.320	2.170	1.577
TR04	0.270	0.240	0.250	0.253	0.460	0.670	0.790	0.640
TR11	0.320	0.470	0.370	0.387	0.410	0.600	0.550	0.520
Riparian Woodland	0.030	0.030	0.060	0.040	7.200	7.290	8.230	7.573
TR03	0.070	0.070	0.140	0.093	5.960	5.450	6.860	6.090
TR05	0.000	0.000	0.000	0.000	5.540	5.240	4.280	5.020
TR10	0.030	0.030	0.050	0.037	10.100	11.180	13.550	11.610
Reclaimed Grassland	0.010	0.010	0.010	0.010	0.004	0.002	0.002	0.003
TR07	0.010	0.010	0.004	0.008	0.002	0.002	0.002	0.002
TR08	0.000	0.000	0.002	0.001	0.010	0.004	0.004	0.006
TR09	0.020	0.010	0.010	0.013	0.000	0.000	0.000	0.000

Site values are based on n=5.
Community values are based on n=15.

TABLE 7. ECMP BASAL COVER AMOUNTS BY SITE AND COMMUNITY (1994-1995)

	% Vegetation			% Litter			% Rock			% Bare Ground			% Water		
Sample Site	1994	1995	94-95 Mean	1994	1995	94-95 Mean	1994	1995	94-95 Mean	1994	1995	94-95 Mean	1994	1995	94-95 Mean
Xeric Mixed Grassland Community	19.3	15.7	17.5	65.3	60.9	63.1	13.9	16.3	15.1	1.5	7.1	4.3	0.0	0.0	0.0
TR01	19.2	15.8	17.5	57.0	51.2	54.1	21.6	23.8	22.7	2.2	9.2	5.7	0.0	0.0	0.0
TR06	21.6	16.2	18.9	73.4	74.2	73.8	3.4	5.4	4.4	1.6	4.2	2.9	0.0	0.0	0.0
TR12	17.2	15.0	16.1	65.4	57.4	61.4	16.8	19.8	18.3	0.6	7.8	4.2	0.0	0.0	0.0
Mesic Mixed Grassland Community	29.1	19.7	24.4	55.3	58.8	57.1	14.0	16.9	15.4	1.7	4.7	3.2	0.0	0.0	0.0
TR02	21.4	17.8	19.6	56.0	53.2	54.6	21.0	22.8	21.9	1.6	6.2	3.9	0.0	0.0	0.0
TR04	40.4	24.0	32.2	51.0	57.2	54.1	6.2	12.8	9.5	2.6	6.0	4.3	0.0	0.0	0.0
TR11	25.4	17.2	21.3	59.0	66.0	62.5	14.8	15.0	14.9	0.8	1.8	1.3	0.0	0.0	0.0
Riparian Woodland Community	19.2	10.5	14.9	65.3	60.9	63.1	13.2	18.5	15.9	1.3	4.7	3.0	1.1	5.4	3.2
TR03	18.2	12.4	15.3	74.0	66.8	70.4	6.0	12.6	9.3	1.4	2.6	2.0	0.4	5.6	3.0
TR05	11.6	8.6	10.1	55.6	39.0	47.3	29.2	36.8	33.0	0.8	6.2	3.5	2.8	9.4	6.1
TR10	27.8	10.6	19.2	66.2	76.8	71.5	4.4	6.2	5.3	1.6	5.2	3.4	0.0	1.2	0.6
Reclaimed Grassland Community	11.2	5.8	8.5	70.4	64.9	67.7	13.3	18.3	15.8	5.1	11.0	8.0	0.0	0.0	0.0
TR07	7.4	6.4	6.9	73.4	58.6	66.0	13.8	19.8	16.8	5.4	15.2	10.3	0.0	0.0	0.0
TR08	6.8	6.0	6.4	71.8	61.2	66.5	12.6	18.6	15.6	8.8	14.2	11.5	0.0	0.0	0.0
TR09	19.4	5.0	12.2	66.0	75.0	70.5	13.6	16.4	15.0	1.0	3.6	2.3	0.0	0.0	0.0

TABLE 8. TOTAL FOLIAR, SHRUB, AND TREE COVER MEANS AT ECMP COMMUNITIES (1993-1995)

Cover Type	Community	1993	1994	1995	93-95 Mean
Foliar	Xeric	76	87	88.7	83.9
Foliar	Mesic	75	91	97	87.7
Foliar	Riparian	61	66	77	68.0
Foliar	Reclaimed	61	80	86	75.7
Shrub	Xeric	NA	1	1	1.0
Shrub	Mesic	NA	1	2	1.5
Shrub	Riparian	NA	40	39	39.5
Shrub	Reclaimed	NA	0	0	0.0
Tree	Xeric	NA	0	0	0.0
Tree	Mesic	NA	0	0	0.0
Tree	Riparian	NA	19	19	19.0
Tree	Reclaimed	NA	0	0	0.0

NA = not available
Community means based on n=15
Values are percentages.

TABLE 9. FOLIAR COVER COMPARISONS AT XERIC MIXED GRASSLAND ECMP SITES FOR 1993, 1994, AND 1995

			XERIC GRASSLAND SITES																										
			TR01-93			TR01-94			TR01-95			TR06-93			TR06-94			TR06-95			TR12-93			TR12-94			TR12-95		
	SPECODE	NATIVE	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER
SCIENTIFIC NAME																													
AGAVACEAE																													
Yucca glauca Nutt.	YUGL1	Y										20	0.26	0.2															
APIACEAE																													
Lomatium orientale Coult. & Rose	LOOR1	Y				20	0.25	0.2																					
ASCELPIADACEAE																													
Asclepias viridiflora Raf.	ASVI1	Y																			20	0.25	0.2						
ASTERACEAE																													
Achillea millefolium L. ssp. lanulosa (Nutt.) Piper	ACMI1	Y																			20	0.25	0.2						
Ambrosia psilostachya DC.	AMPS1	Y	20	0.28	0.2				20	0.24	0.2	20	0.52	0.4							40	0.5	0.4	20	0.22	0.2	40	0.67	0.6
Antennaria micorophylla Rydb.	ANMI1	Y																						20	0.22	0.2			
Artemisia frigida Willd.	ARFR1	Y				20	0.25	0.2				20	0.26	0.2	20	0.22	0.2	20	0.22	0.2									
Artemisia ludoviciana Nutt.	ARLU1	Y										20	0.26	0.2							40	0.5	0.4				60	1.35	1.2
Aster porteri Gray	ASPO1	Y	60	3.92	2.8	100	10.3	8.4	100	25.1	21.2										60	1	0.8	40	0.44	0.4	80	3.59	3.2
Carduus nutans L.	CANU1	N										60	1.31	1	20	0.22	0.2	20	0.43	0.4									
Centaurea diffusa Lam.	CEDI1	N																									20	0.22	0.2
Chrysopsis fulcrata Greene	CHFU1	Y	20	0.28	0.2	20	0.99	0.8	20	0.24	0.2													20	0.44	0.4			
Chrysopsis villosa Pursh.	CHVI1	Y	100	5.88	4.2	100	4.19	3.4	80	2.36	2				20	0.22	0.2				80	2	1.6	40	0.88	0.8	40	0.45	0.4
Cirsium arvense (L.) Scop.	CIAR1	N										20	0.26	0.2															
Erigeron flagellaris Gray	ERFL1	Y										20	0.26	0.2													40	0.45	0.4
Helianthus pumilus Nutt.	HEPU1	Y										20	0.26	0.2															
Lactuca serriola L.	LASE1	N																20	0.22	0.2									
Liatris punctata Hook.	LIPU1	Y	100	7.56	5.4	100	4.43	3.6	80	2.36	2										60	1.75	1.4	80	3.1	2.8	80	2.47	2.2
Scorzonera laciniata L.	SCLA1	N													40	0.45	0.4										20	0.22	0.2
Thelesperma megapotanicum (Spreng.) O. Ktze.	THME1	Y																20	0.22	0.2									
Tragopogon dubius Scop.	TRDU1	N	20	0.28	0.2				20	0.47	0.4	20	0.26	0.2				60	0.87	0.8	20	0.25	0.2	20	0.22	0.2	40	0.67	0.6
BORAGINACEAE																													
Mertensia lanceolata (Pursh.) A. DC.	MELA1	Y							20	0.24	0.2																		
BRASSICACEAE																													
Alyssum minus (L.) Rothmaler	ALMI1	N	20	0.28	0.2	20	1.97	1.6	20	0.47	0.4				40	1.57	1.4	60	1.3	1.2	40	0.75	0.6	80	5.53	5	100	12.6	11.2
Camelina microcarpa Andrz.	CAMI1	N													80	0.89	0.8	100	4.98	4.6	80	1	0.8	80	1.11	1	60	2.02	1.8
Descurainia richardsonii (Sweet) Schultz	DERI1	Y																20	0.43	0.4									
Erysimum asperum (Nutt.) DC.	ERAS1	Y	20	0.28	0.2	20	0.25	0.2				20	0.26	0.2	60	0.67	0.6												
Lepidium sp.	LEP1																							20	0.22	0.2			
Lesquerella montana (A. Gray) Wats.	LEMO1	Y				40	0.49	0.4	20	0.47	0.4				20	0.22	0.2												
Sisymbrium altissimum L.	SIAL1	N													40	0.67	0.6	60	1.95	1.8				20	0.22	0.2			

 See last page for column heading explanations.

TABLE 9. FOLIAR COVER COMPARISONS AT XERIC MIXED GRASSLAND ECMP SITES FOR 1993, 1994, AND 1995

			XERIC GRASSLAND SITES																										
			TR01-93			TR01-94			TR01-95			TR06-93			TR06-94			TR06-95			TR12-93			TR12-94			TR12-95		
	SPECCODE	NATIVE	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER
SCIENTIFIC NAME																													
CACTACEAE																													
Echinocereus viridiflorus Engelm.	ECVI1	Y																						20	0.22	0.2			
Opuntia humifusa (Raf.) Raf.	OPHU1	Y																						40	0.44	0.4			
CARYOPHYLLACEAE																													
Arenaria fendleri A. Gray	ARFE2	Y	100	8.96	6.4	100	6.65	5.4	80	3.31	2.8										100	5.24	4.2	100	6.19	5.6	60	2.47	2.2
Paronychia jamesii T. & G.James	PAJA1	Y	40	0.56	0.4	20	0.25	0.2	60	0.71	0.6																		
CLUSIACEAE																													
Hypericum perforatum L.	HYPE1	N	20	0.28	0.2	40	0.74	0.6	20	0.24	0.2										20	0.25	0.2				20	0.22	0.2
CYPERACEAE																													
Carex eleocharis Bailey	CAEL1	Y	100	7.28	5.2							60	4.19	3.2							100	9.23	7.4						
Carex filifolia Nutt.	CAFI1	Y													40	0.45	0.4	20	0.22	0.2									
Carex heliophila Mack.	CAHE1	Y				100	6.4	5.2	100	5.91	5				60	2.46	2.2	60	3.03	2.8				100	10.4	9.4	100	5.61	5
EUPHORBIACEAE																													
Euphorbia robusta (Engelm.) Small	EURO1	Y																						20	0.22	0.2	20	0.22	0.2
FABACEAE																													
Dalea purpurea Vent	DAPU1	Y	20	0.84	0.6																								
Psoralea tenuiflora Pursh.	PSTE1	Y	100	4.2	3	80	2.96	2.4	80	2.36	2	80	1.57	1.2	20	0.22	0.2	60	1.08	1	100	4.24	3.4	80	2.43	2.2	80	1.57	1.4
HYDROPHYLLACEAE																													
Phacelia heterophylla Pursh	PHHE1	Y																			20	0.25	0.2						
LILIACEAE																													
Allium textile A. Nels. & Macbr.	ALTE1	Y				20	0.25	0.2										20	0.22	0.2									
LINACEAE																													
Linum perenne L. var. lewisii (Pursh.) Eat. & Wright	LIPE1	Y										60	0.79	0.6	20	0.22	0.2	40	0.65	0.6									
NYCTAGINACEAE																													
Mirabilis linearis (Pursh.) Heimerl	MILI1	Y										20	0.26	0.2	20	0.22	0.2				20	0.25	0.2						
ONAGRACEAE																													
Calylophus serrulatus (Nutt.) Raven	CASE2	Y							20	0.24	0.2										40	0.75	0.6	40	0.44	0.4	20	0.22	0.2
Oenothera coronopifolia T. & G.	OECO1	Y																			20	0.25	0.2						
POACEAE																													
Agropyron smithii Rydb.	AGSM1	Y										20	0.79	0.6	20	0.22	0.2	20	0.65	0.6									
Andropogon gerardii Vitman	ANGE1	Y	100	15.4	11	100	11.6	9.4	100	10.6	9	40	0.79	0.6	20	0.89	0.8	40	1.08	1	100	14.7	11.8	100	11.3	10.2	100	13.2	11.8
Andropogon scoparius Michx.	ANSC1	Y	100	11.8	8.4	100	10.3	8.4	100	5.44	4.6	40	0.79	0.6	40	0.89	0.8	80	1.52	1.4	100	5.49	4.4	100	2.88	2.6	60	0.9	0.8
Aristida purpurea Nutt. var. longiseta (Steud.) Vasey	ARFE1	Y										20	0.26	0.2	40	0.67	0.6												
Aristida purpurea Nutt. var. robusta (Merrill) Holmgren	ARLO1	Y	80	1.4	1	40	0.49	0.4	60	0.95	0.8	80	1.57	1.2				40	0.65	0.6	60	1	0.8	80	0.88	0.8	40	1.12	1
Bouteloua curtipendula (Michx.) Torr	BOCU1	Y	40	0.56	0.4	80	2.71	2.2	100	2.6	2.2	60	1.31	1	40	0.67	0.6	40	1.3	1.2	100	2.74	2.2	80	2.21	2	80	2.24	2

TABLE 9. FOLIAR COVER COMPARISONS AT XERIC MIXED GRASSLAND ECMP SITES FOR 1993, 1994, AND 1995

			XERIC GRASSLAND SITES																										
			TR01-93			TR01-94			TR01-95			TR06-93			TR06-94			TR06-95			TR12-93			TR12-94			TR12-95		
	SPECCODE	NATIVE	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER
SCIENTIFIC NAME																													
Bouteloua gracilis (H. B. K.) Lag ex Griffiths	BOGR1	Y	40	0.56	0.4	80	1.72	1.4	40	0.71	0.6	60	1.57	1.2	80	2.68	2.4	80	1.95	1.8	80	1.5	1.2	80	1.55	1.4	60	1.12	1
Bouteloua hirsuta Lag	BOHI1	Y	40	0.56	0.4	80	1.72	1.4	20	0.24	0.2	40	1.05	0.8							20	0.25	0.2	40	0.44	0.4	40	0.9	0.8
Bromus japonicus Thunb. ex Murr.	BRJA1	N							40	0.95	0.8	20	0.79	0.6	60	2.46	2.2	80	6.06	5.6				20	0.22	0.2	60	1.12	1
Bromus tectorum L.	BRTE1	N				20	0.25	0.2	20	0.47	0.4				20	0.45	0.4	20	0.22	0.2									
Buchloe dactyloides (Nutt.) Engelm.	BUDA1	Y																			20	0.25	0.2	20	0.22	0.2			
Koeleria pyramidata (Lam.) Beauv.	KOPY1	Y	100	4.48	3.2	80	4.43	3.6	80	1.89	1.6	60	1.31	1	20	0.22	0.2				60	2.49	2	40	0.44	0.4	60	0.67	0.6
Muhlenbergia montana (Nutt.) Hitchc.	MUMO1	Y	80	9.8	7	80	8.37	6.8	80	8.75	7.4										60	1.5	1.2	60	2.21	2	20	0.67	0.6
Muhlenbergia torreyi (Kunth) Hitchc. ex Bush	MUTO1	Y	60	0.84	0.6																								
Poa compressa L.	POCO1	N	80	5.04	3.6	80	4.43	3.6	100	8.98	7.6	40	3.66	2.8	60	5.37	4.8	60	6.28	5.8	80	3.74	3	80	2.43	2.2	80	5.83	5.2
Poa pratensis L.	POPR1	N	60	2.8	2	40	4.43	3.6	20	1.65	1.4	40	4.45	3.4	40	5.82	5.2	40	3.03	2.8	20	0.25	0.2	60	1.11	1	40	0.45	0.4
Sitanion hystrix (Nutt.) Sm.	SIHY1	Y				20	0.25	0.2	40	0.71	0.6													20	0.22	0.2			
Sorghastrum nutans (L.) Nash	SONU1	Y	60	1.4	1	40	0.49	0.4	60	1.18	1										80	1.5	1.2	20	0.22	0.2	40	1.35	1.2
Sporobolus heterolepis (A. Gray) A. Gray	SPHE1	Y				20	0.74	0.6	80	1.18	1													20	0.22	0.2			
Stipa comata Trin. & Rupr.	STCO1	Y	40	1.68	1.2	60	6.4	5.2	60	8.75	7.4	100	61.5	47	100	62.4	55.8	100	49.4	45.6	100	34.9	28	100	39.4	35.6	100	34.8	31
Stipa viridula Trin.	STVI1	Y	20	1.4	1	20	0.25	0.2																					
POLYGONACEAE																													
Eriogonum alatum Torr.	ERAL1	Y	40	0.84	0.6	40	0.74	0.6							20	0.22	0.2												
ROSACEAE																													
Potentilla fissa Nutt.	POFI1	Y																									20	0.22	0.2
Potentilla gracilis Dougl. ex Hook.	POGR1	Y	20	0.28	0.2																								
Potentilla hippiana Lehm.	POHI1	Y	20	0.28	0.2	20	0.25	0.2	20	0.24	0.2																		
SCROPHULARIACEAE																													
Linaria dalmatica (L.) Mill.	LIDA1	N										100	9.16	7	100	8.05	7.2	100	11.9	11	20	1	0.8	40	1.11	1	20	0.45	0.4
Verbascum thapsus L.	VETH1	N										20	0.26	0.2	20	0.22	0.2	20	0.22	0.2									
Totals					71.4			81.2			84.6			76.4			89.4			92.4			80.2			90.4			89.2

Frequency = percentage of the total number of transects that a given species was encountered on (n=5)
Relative Cover = mean percent cover of a given species expressed as a percentage of the total vegetative cover of all species encountered (n=5)(total # hits of a species/total # hits of all species)
Absolute Cover = the mean number of hits of a given species expressed as a percentage of the total number of hits possible (100 hits/transect; n=5)(total # hits of a species/total number of hits possible)

TABLE 10. FOLIAR COVER COMPARISONS AT MESIC MIXED GRASSLAND ECMP SITES FOR 1993, 1994, AND 1995

MESIC GRASSLAND SITES

SCIENTIFIC NAME	SPEC-CODE	NATIVE	TR02-93 FREQUENCY	TR02-93 RELATIVE COVER	TR02-93 ABSOLUTE COVER	TR02-94 FREQUENCY	TR02-94 RELATIVE COVER	TR02-94 ABSOLUTE COVER	TR02-95 FREQUENCY	TR02-95 RELATIVE COVER	TR02-95 ABSOLUTE COVER	TR04-93 FREQUENCY	TR04-93 RELATIVE COVER	TR04-93 ABSOLUTE COVER	TR04-94 FREQUENCY	TR04-94 RELATIVE COVER	TR04-94 ABSOLUTE COVER	TR04-95 FREQUENCY	TR04-95 RELATIVE COVER	TR04-95 ABSOLUTE COVER	TR11-93 FREQUENCY	TR11-93 RELATIVE COVER	TR11-93 ABSOLUTE COVER	TR11-94 FREQUENCY	TR11-94 RELATIVE COVER	TR11-94 ABSOLUTE COVER	TR11-95 FREQUENCY	TR11-95 RELATIVE COVER	TR11-95 ABSOLUTE COVER
AGAVACEAE																													
Yucca glauca Nutt.	YUGL1	Y	20	1.76	1.2																								
APIACEAE																													
Lomatium orientale Coult. & Rose	LOOR1	Y																									20	0.21	0.2
ASTERACEAE																													
Achillea millefolium L. ssp. lanulosa (Nutt.) Piper	ACMI1	Y																									20	0.21	0.2
Ambrosia psilostachya DC.	AMPS1	Y							20	0.21	0.2	20	0.56	0.4	20	0.22	0.2				20	0.47	0.4	20	0.21	0.2	20	0.21	0.2
Artemisia dracunculus L.	ARDR1	Y										20	0.28	0.2	40	0.87	0.8	80	1.83	1.8							20	0.21	0.2
Artemisia frigida Willd	ARFR1	Y	40	0.59	0.4	60	0.91	0.8	40	0.62	0.6	20	0.28	0.2													20	0.21	0.2
Artemisia ludoviciana Nutt.	ARLU1	Y	20	0.59	0.4	20	0.45	0.4	40	0.41	0.4	20	0.28	0.2				20	0.61	0.6	100	4.49	3.8	60	1.48	1.4	100	3.36	3.2
Aster ericoides L.	ASER1	Y	60	0.88	0.6	20	0.23	0.2	40	0.41	0.4	60	1.97	1.4	40	0.66	0.6	80	1.83	1.8	40	0.47	0.4						
Aster porteri Gray	ASPO1	Y	20	0.29	0.2				40	0.62	0.6																20	0.21	0.2
Carduus nutans L.	CANU1	N										60	1.97	1.4	40	0.44	0.4	40	2.03	2	60	1.89	1.6				60	2.31	2.2
Centaurea diffusa Lam.	CEDI1	N	20	0.59	0.4	60	0.68	0.6	60	1.65	1.6																		
Chrysopsis villosa Pursh.	CHVI1	Y	80	2.05	1.4	20	0.45	0.4	20	0.41	0.4	20	0.28	0.2	20	0.22	0.2												
Cirsium arvense (L.) Scop.	CIAR1	N																			20	0.24	0.2						
Cirsium undulatum (Nutt.) Spreng.	CIUN1	Y				20	0.23	0.2																					
Erigeron divergens T. & G.	ERDI1	Y	20	0.59	0.4										20	0.22	0.2												
Erigeron flagellaris Gray	ERFL1	Y	20	0.59	0.4	40	0.45	0.4	20	0.41	0.4	20	0.28	0.2	20	0.66	0.6	20	0.2	0.2	40	0.47	0.4	20	0.42	0.4			
Grindelia squarrosa (Pursh.) Dun.	GRSQ1	Y	20	0.29	0.2	20	0.23	0.2	60	1.23	1.2	20	0.28	0.2	20	0.44	0.4	60	1.42	1.4							40	0.42	0.4
Gutierrezia sarothrae (Pursh.) Britt. & Rusby	GUSA1	Y							60	0.62	0.6	20	0.28	0.2	40	0.66	0.6	40	0.61	0.6				20	0.21	0.2	20	0.21	0.2
Helianthus petiolaris Nutt.	HEPE1	Y																									20	0.21	0.2
Kuhnia chlorolepis Woot. & Stand.	KUCH1	Y																			20	0.24	0.2						
Kuhnia eupatorioides L.	KUEU1	Y																						20	0.42	0.4	20	0.42	0.4
Lactuca serriola L.	LASE1	N							20	0.21	0.2							20	0.2	0.2	20	0.24	0.2				80	1.26	1.2
Liatris punctata Hook.	LIPU1	Y	20	0.29	0.2	20	0.23	0.2	40	1.85	1.8										20	0.24	0.2						
Ratibida columnifera (Nutt.) Woot. & Standl.	RACO1	Y	80	1.76	1.2				80	1.23	1.2				20	0.44	0.4	40	0.41	0.4									
Scorzonera laciniata L.	SCLA1	N				100	2.05	1.8	80	1.65	1.6	60	1.97	1.4	60	3.06	2.8	100	3.85	3.8									
Solidago missouriensis Nutt.	SOMI1	Y																						20	0.21	0.2			
Tragopogon dubius Scop.	TRDU1	N	60	1.76	1.2	20	0.45	0.4	80	3.09	3	40	0.84	0.6				60	0.81	0.8	60	1.18	1				20	0.21	0.2
BRASSICACEAE																													
Alyssum minus (L.) Rothmaler	ALMI1	N	20	1.17	0.8	40	1.82	1.6	60	2.06	2	40	1.12	0.8	40	1.97	1.8	40	1.42	1.4	60	1.42	1.2	60	2.97	2.8	60	3.15	3
Camelina microcarpa Andrz.	CAMI1	N										20	0.28	0.2	60	1.31	1.2	60	1.22	1.2	20	0.71	0.6	60	2.97	2.8	40	1.89	1.8
Descurainia pinnata (Walt.) Britt.	DEPI1	Y													20	0.22	0.2												
Descurainia richardsonii (Sweet) Schultz	DERI1	Y																						40	0.42	0.4	20	0.21	0.2
Erysimum asperum (Nutt.) DC	ERAS1	Y				20	0.23	0.2																					
Lepidium sp.	LEP1														20	0.22	0.2												
Lesquerella montana (A. Gray) Wats	LEMO1	Y							20	0.21	0.2																		

TABLE 10. FOLIAR COVER COMPARISONS AT MESIC MIXED GRASSLAND ECMP SITES FOR 1993, 1994, AND 1995

MESIC GRASSLAND SITES

SCIENTIFIC NAME	SPEC-CODE	NATIVE	TR02-93			TR02-94			TR02-95			TR04-93			TR04-94			TR04-95			TR11-93			TR11-94			TR11-95		
			FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER
Sisymbrium altissimum L.	SIAL1	N				20	0.23	0.2							40	0.44	0.4	20	0.61	0.6	20	0.71	0.6	20	0.21	0.2	20	1.26	1.2
CACTACEAE																													
Opuntia humifusa (Raf.) Raf.	OPHU1	Y													20	0.22	0.2												
CLUSIACEAE																													
Hypericum perforatum L.	HYPE1	N							20	0.21	0.2																		
CONVOLVULACEAE																													
Convolvulus arvensis L.	COAR1	N							20	0.21	0.2										20	0.24	0.2						
Evolvulus nuttallanus R. & S.	EVNU1	Y	20	0.29	0.2																								
CYPERACEAE																													
Carex eleocharis Bailey	CAEL1	Y	40	4.99	3.4				20	0.21	0.2	40	2.53	1.8	20	0.44	0.4	20	0.41	0.4	40	4.26	3.6						
Carex heliophila Mack.	CAHE1	Y				40	4.09	3.6	20	2.88	2.8													100	9.32	8.8	100	3.99	3.8
Carex oreocharis Holm.	CAOR1	Y																			60	3.78	3.2						
FABACEAE																													
Astragalus flexuosus (Hook.)G. Don	ASFL1	Y				20	0.45	0.4	20	0.21	0.2																		
Dalea candida Willd.	DACA1	Y							20	0.21	0.2													20	0.21	0.2			
Dalea purpurea Vent	DAPU1	Y																			20	0.24	0.2	40	0.64	0.6			
Psoralea tenuiflora Pursh.	PSTE1	Y	80	3.52	2.4	60	2.5	2.2	100	7.82	7.6	80	1.97	1.4	80	2.62	2.4	100	3.65	3.6	100	4.49	3.8	100	2.12	2	100	3.36	3.2
Vicia americana Muhl. ex Willd.	VIAM1	Y													20	0.22	0.2												
HYDROPHYLLACEAE																													
Phacelia heterophylla Pursh	PHHE1	Y																			20	0.47	0.4						
LINACEAE																													
Linum perenne L. var. lewisii (Pursh.) Eat. & Wright	LIPE1	Y				40	1.36	1.2				20	0.84	0.6	20	0.22	0.2												
MALVACEAE																													
Sphaeralcea coccinea (Pursh.) Rydb.	SPCO1	Y	20	0.88	0.6	20	0.68	0.6	20	0.41	0.4	20	0.28	0.2															
NYCTAGINACEAE																													
Mirabilis linearis (Pursh.) Heimerl	MILI1	Y	20	0.29	0.2	40	0.45	0.4				20	0.28	0.2	20	0.22	0.2	20	0.2	0.2	20	0.24	0.2						
ONAGRACEAE																													
Gaura coccinea Pursh.	GACO1	Y				20	0.23	0.2	20	0.21	0.2				40	0.44	0.4	20	0.2	0.2									
POACEAE																													
Agropyron intermedium (Host) Beauv.	AGIN1	N										20	3.37	2.4															
Agropyron smithii Rydb.	AGSM1	Y	100	40.5	27.6	100	33	29	100	31.5	30.6	100	28.6	20.4	100	15.7	14.4	100	19.3	19	100	20.1	17	80	11.7	11	100	11.6	11
Andropogon gerardii Vitman	ANGE1	Y	40	3.23	2.2	40	1.59	1.4	40	1.85	1.8										80	8.75	7.4	60	4.03	3.8	60	3.78	3.6
Andropogon scoparius Michx	ANSC1	Y	40	0.59	0.4	20	0.23	0.2																40	0.42	0.4			
Aristida purpurea Nutt. var. longiseta (Steud.) Vasey	ARFE1	Y										20	0.28	0.2	20	0.22	0.2							40	0.42	0.4			
Aristida purpurea Nutt. var. robusta (Merrill) Holmgren & Holmgren	ARLO1	Y	60	1.76	1.2	20	0.68	0.6	40	0.41	0.4				20	0.22	0.2	20	0.41	0.4	40	2.36	2	40	0.85	0.8	60	1.68	1.6
Bouteloua curtipendula (Michx.) Torr.	BOCU1	Y	80	4.69	3.2	80	5.45	4.8	40	2.67	2.6	40	0.56	0.4	40	1.75	1.6	20	0.2	0.2	40	1.42	1.2	40	0.85	0.8			
Bouteloua gracilis (H. B. K.) Lag ex Griffiths	BOGR1	Y	80	9.97	6.8	100	13.4	11.8	60	2.88	2.8	80	7.58	5.4	80	6.77	6.2	80	2.64	2.6	40	1.18	1	100	1.69	1.6	60	0.84	0.8
Bouteloua hirsuta Lag	BOHI1	Y	60	1.76	1.2	60	2.27	2							20	0.44	0.4	20	0.2	0.2				20	0.21	0.2			

TABLE 10. FOLIAR COVER COMPARISONS AT MESIC MIXED GRASSLAND ECMP SITES FOR 1993, 1994, AND 1995

			MESIC GRASSLAND SITES																									
			TR02-93			TR02-94			TR02-95			TR04-93			TR04-94			TR04-95			TR11-93			TR11-94			TR11-95		
SCIENTIFIC NAME	SPEC-CODE	NATIVE	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER
Bromus inermis Leyss.	BRIN1	N	20	0.59	0.4	20	0.45	0.4	20	0.62	0.6																		
Bromus japonicus Thunb. ex Murr.	BRJA1	N	100	8.21	5.6	100	20.9	18.4	100	28.4	27.6	100	37.6	26.8	100	48.7	44.6	100	47.3	46.6	100	13	11	100	25.8	24.4	100	39.1	37.2
Bromus tectorum L.	BRTE1	N													40	4.59	4.2	40	3.04	3	40	0.95	0.8	60	8.05	7.6	80	8.4	8
Buchloe dactyloides (Nutt.) Engelm.	BUDA1	Y	40	0.59	0.4	60	1.14	1	20	0.21	0.2				20	0.66	0.6												
Koeleria pyramidata (Lam.) Beauv.	KOPY1	Y										20	0.28	0.2	20	0.22	0.2				20	0.24	0.2						
Muhlenbergia montana (Nutt.) Hitchc.	MUMO1	Y										20	0.28	0.2															
Muhlenbergia wrightii Vasey	MUWR1	Y																20	0.2	0.2				20	0.42	0.4			
Poa compressa L.	POCO1	N	40	1.47	1	40	0.45	0.4	20	0.21	0.2	60	1.12	0.8	60	0.87	0.8	80	1.62	1.6	40	2.84	2.4	40	1.69	1.6	40	1.89	1.8
Poa pratensis L.	POPR1	N	20	0.29	0.2	20	0.23	0.2				60	2.81	2	80	1.75	1.6	40	1.22	1.2	60	7.8	6.6	80	6.36	6	80	1.89	1.8
Poaceae sp.	PO1								20	0.21	0.2																		
Sporobolus cryptandra (Torr.) A. Gray	SPCR1	Y	20	0.29	0.2																								
Sporobolus heterolepis (A. Gray) A. Gray	SPHE1	Y																						20	0.42	0.4			
Stipa comata Trin. & Rupr.	STCO1	Y	40	2.64	1.8	40	1.14	1	20	0.62	0.6				20	0.22	0.2				100	11.6	9.8	60	8.69	8.2	80	3.15	3
Stipa viridula Trin.	STVI1	Y	20		0.2	40	0.68	0.6	40	1.03	1				40	0.66	0.6	40	0.81	0.8	20	2.36	2	60	4.24	4	60	2.94	2.8
POLYGONACEAE																													
Eriogonum alatum Torr.	ERAL1	Y							20	0.21	0.2																		
Polygonum sawatchense Small	POSA1	Y																20	0.2	0.2									
SCROPHULARIACEAE																													
Linaria dalmatica (L.) Mill.	LIDA1	N										20	0.84	0.6	80	0.87	0.8	60	1.42	1.4	40	0.95	0.8	40	2.33	2.2	60	1.26	1.2
Verbascum thapsus L.	VETH1	N																											
Total Absolute Cover (%)					68.2			88			97.2			71.2			91.6			98.6			84.6			94.4			95.2

Frequency = percentage of the total number of transects that a given species was encountered on (n=5)
Relative Cover = mean percent cover of a given species expressed as a percentage of the total vegetative cover of all species encountered (n=5)(total # hits of a species/total # hits of all species)
Absolute Cover = the mean number of hits of a given species expressed as a percentage of the total number of hits possible (100 hits/transect, n=5)(total # hits of a species/total number of hits possible)

TABLE 11. FOLIAR COVER COMPARISONS AT RECLAIMED GRASSLAND ECMP SITES FOR 1993, 1994, AND 1995

			RECLAIMED GRASSLAND SITES																										
			TR07-93			TR07-94			TR07-95			TR08-93			TR08-94			TR08-95			TR09-93			TR09-94			TR09-95		
SCIENTIFIC NAME	SPECCODE	NATIVE	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER
ASTERACEAE																													
Artemisia campestris L.	ARCA1	Y				20	0.27	0.2																					
Aster porteri Gray	ASPO1	Y	20	0.33	0.2				20	0.23	0.2																		
Chrysopsis villosa Pursh.	CHVI1	Y	20	0.67	0.4	40	1.34	1	40	0.68	0.6				20	0.29	0.2												
Cirsium arvense (L.) Scop.	CIAR1	N	60	1	0.6	20	0.27	0.2	20	0.23	0.2				40	0.57	0.4	40	0.54	0.4	20	0.3	0.2						
Cirsium undulatum (Nutt.) Spreng.	CIUN1	Y							20	0.23	0.2																		
Gutierrezia sarothrae (Pursh.) Britt. & Rusby	GUSA1	Y				40	0.53	0.4	40	0.91	0.8				20	0.29	0.2												
Kuhnia eupatorioides L.	KUEU1	Y																20	0.27	0.2									
Senecio spartioides T. & G.	SESP1	Y										20	0.36	0.2	20	0.29	0.2												
Tragopogon dubius Scop.	TRDU1	N				20	0.27	0.2																					
BRASSICACEAE																													
Alyssum minus (L.) Rothmaler	ALMI1	N	40	0.67	0.4	60	3.21	2.4	80	4.34	3.8							60	3.22	2.4	20	0.3	0.2	60	2.51	2.4	80	2.92	2.8
Camelina microcarpa Andrz.	CAMI1	N																									20	0.21	0.2
CLUSIACEAE																													
Hypericum perforatum L.	HYPE1	N	20	0.33	0.2	20	0.27	0.2																					
CONVOLVULACEAE																													
Convolvulus arvensis L.	COAR1	N							20	0.23	0.2				20	0.57	0.4	20	0.8	0.6	60	2.08	1.4	60	0.84	0.8	80	2.09	2
FABACEAE																													
Astragalus flexuosus (Hook.)G. Don	ASFL1	Y																20	0.27	0.2									
Melilotus alba Medic.	MEAL1	N													20	0.57	0.4	40	3.75	2.8									
Melilotus officinalis (L.) Pall.	MEOF1	N	100	9.7	5.8	80	4.28	3.2	100	12.1	10.6	40	1.08	0.6				60	2.41	1.8									
Melilotus sp.	MEL1	N										80	5.05	2.8															
Medicago lupulina L.	MELU1	N				40	0.53	0.4																					
Medicago sativa L.	MESA1	N																						20	0.21	0.2			
Psoralea tenuiflora Pursh.	PSTE1	Y							20	0.23	0.2																		
Vicia americana Muhl. ex Willd.	VIAM1	Y																40	0.54	0.4							20	0.21	0.2
POACEAE																													
Agropyron cristatum (L.) Gaertn.	AGCR1	N	80	12	7.2				40	0.46	0.4	20	2.53	1.4				40	0.54	0.4	80	9.79	6.6	60	0.63	0.6			
Agropyron intermedium (Host) Beauv.	AGIN1	N	100	26.8	16	100	38	28.4	100	42.2	37	80	9.03	5	100	20.6	14.4	100	22	16.4	100	40.7	27.4	100	49.5	47.4	100	52	49.8
Agropyron smithii Rydb.	AGSM1	Y	40	2.01	1.2	20	1.6	1.2				40	8.66	4.8							40	2.67	1.8						
Aristida purpurea Nutt. var. robusta (Merrill) Holm. & Holm.	ARLO1	Y	20	0.33	0.2	20	0.53	0.4	40	0.68	0.6				20	0.29	0.2	20	0.27	0.2									
Bromus inermis Leyss.	BRIN1	N	100	46.2	27.6	100	48.4	36.2	100	37.2	32.6	100	73.3	40.6	100	76.6	53.6	100	65.4	48.8	100	44.2	29.8	100	46.1	44.2	100	42	40.2
Bromus japonicus Thunb. ex Murr.	BRJA1	N				40	0.53	0.4	20	0.23	0.2													20	0.21	0.2	40	0.42	0.4
Poa pratensis L.	POPR1	N																									20	0.21	0.2
Total Cover					59.8			74.8			87.6			55.4			70			74.6			67.4			95.8			95.8

Frequency = percentage of the total number of transects that a given species was encountered on (n=5)

Relative Cover = mean percent cover of a given species expressed as a percentage of the total vegetative cover of all species encountered (n=5)(total # hits of a species/total # hits of all species)

Absolute Cover = the mean number of hits of a given species expressed as a percentage of the total number of hits possible (100 hits/transect; n=5)(total # hits of a species/total number of hits possible)

TABLE 12. FOLIAR COVER COMPARISONS AT RIPARIAN WOODLAND ECMP SITES FOR 1993, 1994, AND 1995

			RIPARIAN SITES																										
			TR03-93			TR03-94			TR03-95			TR05-93			TR05-94			TR05-95			TR10-93			TR10-94			TR10-95		
SCIENTIFIC NAME	SPECCODE	NATIVE	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER
ANACARDIACEAE																													
Toxicodendron rydbergii (Small ex Rydberg) Greene	TORY1	Y																			20	0.89	0.6	20	0.84	0.6			
APIACEAE																													
Cicuta maculata L.	CIMA1	Y				20	0.27	0.2	20	0.45	0.4																		
Conium maculatum L.	COMA1	N	20	0.29	0.2										20	3.01	1.6	20	2.09	1.2									
ASCLEPIADACEAE																													
Asclepias speciosa Torr.	ASSP1	Y	60	1.47	1	40	0.53	0.4	20	1.35	1.2	20	0.82	0.4							40	1.19	0.8	80	1.96	1.4	80	1.42	1.2
ASTERACEAE																													
Achillea millefolium L. ssp. lanulosa (Nutt.) Piper	ACMI1	Y	40	1.18	0.8	20	0.53	0.4																					
Ambrosia psilostachya DC.	AMPS1	Y				20	0.27	0.2	20	0.22	0.2	40	3.67	1.8	20	0.38	0.2	40	0.7	0.4	40	0.59	0.4	20	0.28	0.2	40	0.94	0.8
Arctium minus Bernh.	ARMI1	Y							20	0.22	0.2																		
Artemisia frigida Willd.	ARFR1	Y																			20	0.3	0.2						
Artemisia ludoviciana Nutt.	ARLU1	Y																						20	0.84	0.6	20	0.47	0.4
Aster ericoides L.	ASER1	Y	60	0.88	0.6	20	0.27	0.2	20	0.22	0.2				20	0.38	0.2	20	0.7	0.4	100	3.86	2.6	40	0.84	0.6	20	0.24	0.2
Aster hesperius A. Gray	ASHE1	Y							20	0.22	0.2																20	0.47	0.4
Aster porteri Gray	ASPO1	Y																									20	0.24	0.2
Carduus nutans L.	CANU1	N	20	0.29	0.2										20	0.75	0.4												
Centaurea diffusa Lam	CEDI1	N	20	0.59	0.4	20	0.27	0.2																					
Cichorium intybus L.	CIIN1	N																			20	1.19	0.8	20	1.4	1	40	3.3	2.8
Cirsium arvense (L.) Scop.	CIAR1	N	100	10.6	7.2	100	9.87	7.4	100	9.66	8.6	100	25.7	12.6	100	16.9	9	60	13.6	7.8	80	11.9	8	60	7.28	5.2	60	10.4	8.8
Conyza canadensis (L.) Cronq.	COCA1	Y																			20	2.97	2	20	1.12	0.8			
Lactuca serriola L.	LASE1	N							60	0.9	0.8	20	2.45	1.2	20	0.75	0.4	20	1.05	0.6	40	1.19	0.8	60	1.4	1	40	0.47	0.4
Solidago missouriensis Nutt.	SOMI1	Y	20	0.29	0.2				40	0.45	0.4										40	0.89	0.6	40	1.12	0.8	40	0.47	0.4
Solidago mollis Bart.	SOMO1	Y													20	0.75	0.4												
Solidago rigida L.	SORI1	Y							20	0.22	0.2																		
Sonchus asper (L.) Hill	SOAS1	N							20	0.22	0.2																		
Taraxacum officinale Weber	TAOF1	N																									20	0.24	0.2
Xanthium strumarium L.	XAST1	Y																40	0.7	0.4									
BORAGINACEAE																													
Cynoglossum officinale L.	CYOF1	N							20	0.22	0.2										20	0.3	0.2	20	0.56	0.4	60	0.71	0.6
Onosmodium molle Michx.	ONMO1	Y	40	0.59	0.4	40	0.8	0.6																					
BRASSICACEAE																													
Alyssum minus (L.) Rothmaler	ALMI1	N							20	0.22	0.2																		
Barbarea orthoceras Ledeb.	BAOR1	N				60	4	3	60	2.25	2	20	1.22	0.6	60	4.51	2.4	20	1.39	0.8									
Descurainia richardsonii (Sweet) Schultz	DERI1	Y							20	0.22	0.2																		
Nasturtium officinale R. Br.	NAOF1	N							20	3.82	3.4																		
Sisymbrium altissimum L.	SIAL1	N	20	0.29	0.2																								
CLUSIACEAE																													

TABLE 12. FOLIAR COVER COMPARISONS AT RIPARIAN WOODLAND ECMP SITES FOR 1993, 1994, AND 1995

			RIPARIAN SITES																										
			TR03-93			TR03-94			TR03-95			TR05-93			TR05-94			TR05-95			TR10-93			TR10-94			TR10-95		
	SPECCODE	NATIVE	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER
SCIENTIFIC NAME																													
Hypericum perforatum L.	HYPE1	N	40	0.59	0.4	40	0.53	0.4	20	0.22	0.2																		
CYPERACEAE																													
Carex brevior (Dew.) Mack. ex Lunell.	CABR1	Y							20	0.22	0.2							20	0.35	0.2							100	10.6	9
Carex eleocharis Bailey	CAEL1	Y																									40	0.71	0.6
Carex lanuginosa Michx.	CALA1	Y							40	1.57	1.4				20	0.75	0.4												
Carex nebraskensis Dew.	CANE1	Y	80	10.6	7.2	60	9.6	7.2	80	8.31	7.4	60	2.45	1.2	40	7.14	3.8	60	3.48	2	60	1.19	0.8	60	9.52	6.8	60	2.83	2.4
Carex praegracilis W. Boott.	CAPR1	Y				20	0.8	0.6	20	2.47	2.2																20	0.71	0.6
Carex stipata Muhl.	CAST1	Y																						20	1.68	1.2			
Eleocharis acicularis (L.) R. & S.	ELAC1	Y																			20	4.15	2.8						
Eleocharis macrostachya Britt.	ELMA1	Y							60	3.15	2.8							40	1.74	1							40	2.12	1.8
Eleocharis parvula (R. & S.) Link ex Bluff	ELPA1	Y				40	1.6	1.2							20	0.38	0.2												
Scirpus americanus Pers.	SCAM1	Y										20	0.41	0.2	20	2.26	1.2	40	2.09	1.2									
Scirpus pallidus (Britt.) Fern	SCPA1	Y				40	1.07	0.8	20	0.45	0.4				20	1.5	0.8												
Scirpus validus Vahl.	SCVA1	Y										20	0.82	0.4	40	0.75	0.4												
EQUISETACEAE																													
Equisetum arvense L.	EQAR1	Y							20	0.22	0.2																		
Equisetum hymale L.	EQHY1	Y																			20	0.59	0.4						
Equisetum laevigatum A. Br.	EQLA1	Y																						40	0 84	0.6	40	1.65	1.4
FABACEAE																													
Glycyrrhiza lepidota Pursh.	GLLE1	Y				40	4.8	3.6	20	3.82	3.4				20	1.88	1	40	2.79	1.6				20	3.64	2.6	40	1.89	1.6
Lathyrus eucosmus Butters and St. John	LAEU1	Y																									20	0.24	0.2
Lupinus argenteus Pursh.	LUAR1	Y	20	0.29	0.2	20	0.27	0.2																					
Medicago lupulina L.	MELU1	N																			20	0.3	0.2						
Melilotus alba Medic.	MEAL1	N																20	0.35	0.2									
Psoralea tenuiflora Pursh.	PSTE1	Y							20	0.22	0.2																		
Thermopsis rhombifolia var. divaricarpa Nels.	THRH1	Y	60	3.53	2.4	40	1.07	0.8	60	0.67	0.6	20	2.45	1.2	20	1.13	0.6	20	1.05	0.6	60	1.48	1	40	2.24	1.6	40	0.94	0.8
GERANIACEAE																													
Geranium caespitosum James	GECA1	Y	20	1.47	1	60	1.6	1.2	20	0.67	0.6																		
JUNCACEAE																													
Juncus balticus Willd.	JUBA1	Y	100	30	20.4	100	37.1	27.8	100	20	17.8	40	8.16	4	40	9.77	5.2	20	4.53	2.6	60	19.3	13	60	16.2	11 6	60	6.6	5.6
Juncus dudleyi Wieg.	JUDU1	Y	20	0.59	0 4																20	1.19	0.8				20	0.24	0.2
Juncus ensifolius Wikst. var montanus (Engim.) C. L. Hitchc.	JUEN1	Y							20	0.22	0.2																		
Juncus torreyi Cov	JUTO1	Y																20	0.35	0.2									
LAMIACEAE																													
Lycopus americanum Muhl. ex Barton	LYAM1	Y							20	0.22	0.2																		
Mentha arvensis L.	MEAR1	Y	20	1.76	1.2	60	1.07	0.8	60	0.9	0.8				20	0.38	0.2	20	0.35	0.2	40	0.59	0.4	20	0.56	0.4	20	0.24	0.2
Monarda fistulosa L.	MOFI1	Y	40	2.35	1.6	20	1.87	1.4	20	0.9	0.8													40	0.56	0.4	20	0.47	0.4
Nepeta cataria L	NECA1	N	40	0.59	0.4	20	0.27	0.2													60	3.26	2.2	20	0 56	0.4	20	0.24	0.2

4/23/97 TABLE12.XLS See last page for column heading explanations.

TABLE 12. FOLIAR COVER COMPARISONS AT RIPARIAN WOODLAND ECMP SITES FOR 1993, 1994, AND 1995

			RIPARIAN SITES																										
			TR03-93			TR03-94			TR03-95			TR05-93			TR05-94			TR05-95			TR10-93			TR10-94			TR10-95		
	SPECCODE	NATIVE	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER
SCIENTIFIC NAME																													
Prunella vulgaris L.	PRVU1	Y							20	0.22	0.2																		
Stachys palustris L.	STPA2	Y				20	0.27	0.2																40	0.56	0.4			
LILIACEAE																													
Asparagus officinalis L.	ASOF1	N																			20	1.19	0.8	20	0.84	0.6			
LINACEAE																													
Linum perenne L. var. lewisii (Pursh.) Eat. & Wright	LIPE1	Y				20	0.27	0.2	20	0.22	0.2																		
ONAGRACEAE																													
Epilobium ciliatum Raf.	EPCI1	Y	60	4.41	3				20	0.22	0.2										40	1.48	1	20	0.84	0.6	20	0.24	0.2
Oenothera biennis L.	OEBI1	Y				40	0.53	0.4	20	0.22	0.2	40	1.63	0.8	20	1.13	0.6	20	0.35	0.2	20	0.3	0.2	20	0.28	0.2			
POACEAE																													
Agropyron intermedium (Host) Beauv.	AGIN1	N	20	0.59	0.4																						20	0.24	0.2
Agropyron repens (L.) Beauv.	AGRE1	N	20	0.59	0.4	20	1.07	0.8	40	2.25	2	20	0.41	0.2				20	0.35	0.2	60	2.37	1.6	20	1.12	0.8	40	2.83	2.4
Agropyron smithii Rydb.	AGSM1	Y	60	3.24	2.2	20	0.53	0.4	40	1.12	1	20	2.04	1				20	0.7	0.4	40	5.64	3.8	40	1.12	0.8	80	3.07	2.6
Agrostis stolonifera L.	AGST1	N	80	8.24	5.6	60	2.67	2	60	1.8	1.6	100	9.39	4.6	80	8.27	4.4	60	6.62	3.8	40	2.67	1.8	60	2.8	2	60	2.36	2
Andropogon gerardii Vitman	ANGE1	Y							20	0.22	0.2																		
Bouteloua gracilis (H. B. K.) Lag ex Griffiths	BOGR1	Y																						20	0.28	0.2			
Bromus inermis Leyss.	BRIN1	N	20	1.18	0.8				20	0.67	0.6	40	2.45	1.2	40	2.26	1.2	40	2.79	1.6	20	2.37	1.6	20	3.64	2.6	20	4.48	3.8
Bromus japonicus Thunb. ex Murr.	BRJA1	N	40	1.18	0.8	40	1.33	1	80	7.64	6.8	40	1.22	0.6	40	1.5	0.8	60	1.74	1	40	2.37	1.6	60	5.32	3.8	80	6.13	5.2
Bromus tectorum L.	BRTE1	N							20	0.22	0.2																20	0.24	0.2
Dactylis glomerata L.	DAGL1	N	20	0.29	0.2																								
Echinochloa crusgalli (L.) Beauv.	ECCR1	N										20	14.3	7															
Elymus canadensis L.	ELCA1	Y	40	2.35	1.6							20	0.41	0.2	20	0.38	0.2	20	0.35	0.2	20	0.3	0.2	40	2.52	1.8	40	0.47	0.4
Festuca pratensis Huds.	FEPR1	Y	20	0.59	0.4	20	0.27	0.2	20	6.74	6	20	0.41	0.2	60	14.7	7.8	100	23.7	13.6									
Glyceria grandis S. Wats. ex A. Gray	GLGR1	Y																40	3.48	2									
Hordeum jubatum L.	HOJU1	Y										20	0.41	0.2				40	0.7	0.4									
Leersia oryzoides (L.) Sw.	LEOR1	Y							20	0.45	0.4																		
Muhlenbergia racemosa (Michx.) B. S. P.	MURA1	Y													20	0.38	0.2												
Panicum virgatum L.	PAVI1	Y																			20	1.78	1.2	20	0.84	0.6	40	1.18	1
Phleum pratense L.	PHPR1	N	20	0.29	0.2				20	0.22	0.2																		
Poa compressa L.	POCO1	N	20	2.65	1.8	20	1.07	0.8	40	0.9	0.8	40	7.76	3.8	40	12	6.4	40	13.9	8	40	15.1	10.2	60	16	11.4	60	19.3	16.4
Poa pratensis L.	POPR1	N	60	2.35	1.6	80	4.8	3.6	80	2.7	2.4	40	4.49	2.2	20	0.75	0.4	40	1.39	0.8	100	4.45	3	60	7	5	100	7.31	6.2
Poaceae sp.	PO1								20	0.22	0.2																		
Sitanion hystrix (Nutt.) Sm.	SIHY1	Y										20	0.82	0.4										20	0.28	0.2			
Sporobolus asper (Michx) Kunth	SPAS1	Y																20	0.35	0.2									
Sporobolus cryptandrus (Torr) A Gray	SPCR1	Y													20	0.38	0.2												
Sporobolus sp.	SPO1																										20	0.24	0.2
Spartina pectinata Link	SPPE1	Y	20	0.29	0.2	20	3.73	2.8	20	1.12	1																		
Stipa robusta (Vasey) Scribn	STRO1	Y																						20	0.28	0.2			

TABLE 12. FOLIAR COVER COMPARISONS AT RIPARIAN WOODLAND ECMP SITES FOR 1993, 1994, AND 1995

			RIPARIAN SITES																										
			TR03-93			TR03-94			TR03-95			TR05-93			TR05-94			TR05-95			TR10-93			TR10-94			TR10-95		
SCIENTIFIC NAME	SPECCODE	NATIVE	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER	FREQUENCY	RELATIVE COVER	ABSOLUTE COVER
Stipa viridula Trin.	STVI1	Y				20	0.27	0.2													20	0.89	0.6				20	0.24	0.2
POLYGONACEAE																													
Rumex crispus L.	RUCR1	N	20	0.29	0.2	20	0.27	0.2	20	0.45	0.4	60	1.63	0.8	20	0.75	0.4							20	0.28	0.2	20	0.24	0.2
Rumex mexicanus Meisn.	RUME1	Y							40	0.9	0.8							20	0.35	0.2									
ROSACEAE																													
Geum macrophyllum Willd.	GEMA1	Y	40	2.35	1.6	20	0.27	0.2	60	2.47	2.2																		
Potentilla hippiana Lehm.	POHI1	Y				40	0.8	0.6																					
RUBIACEAE																													
Galium aparine L.	GAAP1	Y							60	2.47	2.2							20	0.35	0.2							40	1.42	1.2
Galium boreale L.	GABO1	Y				40	2.4	1.8																20	1.4	1			
SCROPHULARIACEAE																													
Linaria dalmatica (L.) Mill.	LIDA1	N										20	0.41	0.2	20	0.38	0.2	20	0.35	0.2									
Scrophularia lanceolata Pursh.	SCLA2	Y																									20	0.47	0.4
Verbascum blattaria L.	VEBL1	N																						20	0.28	0.2			
Veronica americana (Raf.) Schwein. ex Benth.	VEAM1	Y				20	0.27	0.2	20	0.22	0.2													20	0.28	0.2			
Veronica anagallis-aquatica L.	VEAN1	N							20	0.22	0.2																		
SOLANACEAE																													
Physalis heterophylla Nees	PHHE2	Y							20	0.22	0.2																		
TYPHACEAE																													
Typha latifolia L.	TYLA1	Y	40	0.88	0.6	20	0.8	0.6	40	0.67	0.6	20	3.27	1.6	20	3.76	2	20	5.23	3	20	1.19	0.8				20	0.47	0.4
VERBENACEAE																													
Lippia cuneifolia (Torr.) Steud.	LICU1	Y																						20	0.28	0.2			
Verbena bracteata Lag. & Rodr.	VEBR1	Y										40	0.82	0.4															
Verbena hastata L.	VEHA1	Y																			20	0.59	0.4	20	0.28	0.2	20	0.24	0.2
Total Absolute Cover (%)					68			75			89			49			53.2			57.4			67.4			71.4			84.8

Frequency = percentage of the total number of transects that a given species was encountered on (n=5)
Relative Cover = mean percent cover of a given species expressed as a percentage of the total vegetative cover of all species encountered (n=5)(total # hits of a species/total # hits of all species)
Absolute Cover = the mean number of hits of a given species expressed as a percentage of the total number of hits possible (100 hits/transect; n=5)(total # hits of a species/total number of hits possible)

TABLE 13. SHRUB COVER AT ECMP SITES (1994-1995)

Sample Site	Scientific Name	Speccode	Native	1994 Frequency	1994 Relative Cover	1994 Absolute Cover	1995 Frequency	1995 Relative Cover	1995 Absolute Cover
TR02	Rosa arkansana Porter	ROAR1	Y	20	62.50	2.00	20	68.75	2.20
TR02	Yucca glauca Nutt.	YUGL1	Y	40	37.50	1.20	40	37.50	1.20
TR03	Amorpha fruticosa L.	AMFR1	Y	80	58.49	24.80	60	56.95	25.40
TR03	Salix exigua Nutt. ssp. interior (Rowlee) Cronq.	SAEX1	Y	60	26.42	11.20	60	25.11	11.20
TR03	Symphoricarpos occidentalis Hook.	SYOC1	Y	40	8.49	3.60	20	4.04	1.80
TR03	Prunus virginiana L.	PRVI1	Y	20	1.89	0.80	40	2.24	1.00
TR03	Rosa woodsii Lindl.	ROWO1	Y	80	1.89	0.80	0	0.00	0.00
TR03	Populus deltoides Marsh. var occidentalis Rydb.	PODE1	Y	40	1.42	0.60	60	9.42	4.20
TR03	Crataegus erythropoda Ashe	CRER1	Y	20	0.47	0.20	20	0.45	0.20
TR03	Rosa arkansana Porter	ROAR1	Y	20	0.47	0.20	40	1.79	0.80
TR03	Salix lutea Nutt.	SALU1	Y	20	0.47	0.20	0	0.00	0.00
TR04	Rosa arkansana Porter	ROAR1	Y	20	100.00	0.20	40	100.00	0.80
TR05	Salix exigua Nutt. ssp. interior (Rowlee) Cronq.	SAEX1	Y	20	51.70	15.20	20	55.56	16.00
TR05	Populus deltoides Marsh. var occidentalis Rydb.	PODE1	Y	20	21.77	6.40	20	19.44	5.60
TR05	Symphoricarpos occidentalis Hook.	SYOC1	Y	40	12.93	3.80	40	6.94	2.00
TR05	Amorpha fruticosa L.	AMFR1	Y	40	10.88	3.20	40	12.50	3.60
TR05	Salix amygdaloides Anderss.	SAAM1	Y	40	2.04	0.60	60	5.56	1.60
TR05	Rosa woodsii Lindl.	ROWO1	Y	20	0.68	0.20	0	0.00	0.00
TR06	Yucca glauca Nutt.	YUGL1	Y	60	100.00	1.60	100	100.00	1.60
TR08	Yucca glauca Nutt.	YUGL1	Y	0	0.00	0.00	20	100.00	0.20
TR10	Salix exigua Nutt. ssp. interior (Rowlee) Cronq.	SAEX1	Y	60	35.11	15.80	40	36.32	15.40
TR10	Amorpha fruticosa L.	AMFR1	Y	40	34.22	15.40	40	32.55	13.80
TR10	Symphoricarpos occidentalis Hook.	SYOC1	Y	80	12.89	5.80	60	6.60	2.80
TR10	Prunus virginiana L.	PRVI1	Y	60	7.56	3.40	40	8.49	3.60
TR10	Rosa arkansana Porter	ROAR1	Y	40	4.89	2.20	60	9.43	4.00
TR10	Rosa woodsii Lindl.	ROWO1	Y	80	4.44	2.00	20	1.89	0.80
TR10	Salix amygdaloides Anderss.	SAAM1	Y	20	0.89	0.40	20	4.25	1.80
TR10	Populus deltoides Marsh. var occidentalis Rydb.	PODE1	Y	0	0.00	0.00	20	0.47	0.20
TR11	Rosa arkansana Porter	ROAR1	Y	20	100.00	0.60	20	100.00	0.80

Frequency = percentage of transects species occurred in (n=5).
Relative Cover = mean percent cover of a given species expressed as a percentage of the total vegetative cover of all species encountered (n=5)(total # hits of a species/total # hits of all species)
Absolute Cover = the mean number of hits of a given species expressed as a percentage of the total number of hits possible (100 hits/transect; n=5)(total # hits of a species/total number of hits possible)
Shrubs = woody vegetation < 2 m in height.

TABLE 14. TREE COVER AT ECMP SITES (1994-1995)

Sample Site	Scientific Name	Speccode	Native	1994 Frequency	1994 Relative Cover	1994 Absolute Cover	1995 Frequency	1995 Relative Cover	1995 Absolute Cover
TR03	Populus deltoides Marsh. var occidentalis Rydb.	PODE1	Y	60	89.77	15.80	60	95.06	15.40
TR03	Salix exigua Nutt. ssp. interior (Rowlee) Cronq.	SAEX1	Y	20	6.82	1.20	40	3.70	0.60
TR03	Amorpha fruticosa L.	AMFR1	Y	20	3.41	0.60	20	1.23	0.20
TR05	Salix exigua Nutt. ssp. interior (Rowlee) Cronq.	SAEX1	Y	20	61.07	16.00	20	51.35	15.20
TR05	Populus deltoides Marsh. var occidentalis Rydb.	PODE1	Y	40	25.95	6.80	40	37.16	11.00
TR05	Salix amygdaloides Anderss.	SAAM1	Y	60	9.16	2.40	60	10.14	3.00
TR05	Amorpha fruticosa L.	AMFR1	Y	20	3.82	1.00	20	1.35	0.40
TR10	Populus deltoides Marsh. var occidentalis Rydb.	PODE1	Y	20	74.55	8.20	20	71.15	7.40
TR10	Salix amygdaloides Anderss.	SAAM1	Y	20	14.55	1.60	20	11.54	1.20
TR10	Salix exigua Nutt. ssp. interior (Rowlee) Cronq.	SAEX1	Y	20	10.91	1.20	40	17.31	1.80

Frequency = percentage of transects species occurred in (n = 5).
Relative Cover = mean percent cover of a given species expressed as a percentage of the total vegetative cover of all species encountered (n = 5)(total # hits of a species/total # hits of all species)
Absolute Cover = the mean number of hits of a given species expressed as a percentage of the total number of hits possible (100 hits/transect; n = 5)(total # hits of a species/total number of hits possible)
Trees = woody vegetation > 2 m in height.

TABLE 15. PERCENT NATIVE RELATIVE FOLIAR COVER AT ECMP SITES AND COMMUNITIES FROM 1993-1995

Sample Site	Percent Native Relative Foliar Cover			
	1993	1994	1995	93-95 Mean
Xeric Mixed Grassland Community	88.0	83.3	75.2	82.2
TR01	91.3	88.2	86.8	88.8
TR06	79.8	73.8	62.6	72.1
TR12	92.8	87.8	76.2	85.6
Mesic Mixed Grassland Community	67.2	52.7	44.7	54.9
TR02	85.6	72.7	61.5	73.3
TR04	48.0	35.8	35.3	39.7
TR11	67.8	49.6	37.4	51.6
Riparian Woodland Community	49.7	57.8	53.6	53.7
TR03	69.1	73.9	65.2	69.4
TR05	28.6	48.1	54.4	43.7
TR10	51.3	51.5	41.3	48.0
Reclaimed Grassland Community	5.0	1.8	1.5	2.8
TR07	3.3	4.3	3.0	3.5
TR08	9.0	1.1	1.3	3.8
TR09	2.7	0.0	0.2	1.0

Site values *n*=5
Community values n=15

TABLE 16. CURRENT YEAR PRODUCTION BIOMASS AMOUNTS AT ECMP COMMUNITIES (1993-1994)

Community	*Biomass Type*	1993	1994	93-94 Mean
Xeric	Current Year Production (g/m^2)	124.2	128.6	126.4
Xeric	Litter (g/m^2)	115.8	262.9	189.4
Mesic	Current Year Production (g/m^2)	117.4	120.1	118.8
Mesic	Litter (g/m^2)	157.1	225.0	191.1
Reclaimed	Current Year Production (g/m^2)	113.6	145.8	129.7
Reclaimed	Litter (g/m^2)	150.5	227.5	189.0

Community values based on an $n=25$

TABLE 17. BIOMASS AMOUNTS AT XERIC, MESIC, AND RECLAIMED GRASSLAND ECMP SITES FOR 1994

			XERIC GRASSLAND						MESIC GRASSLAND						RECLAIMED GRASSLAND					
			TR01-94		TR06-94		TR12-94		TR02-94		TR04-94		TR11-94		TR07-94		TR08-94		TR09-94	
	SPECCODE	NATIVE	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP
SCIENTIFIC NAME																				
AGAVACEAE																				
Yucca glauca Nutt.	YUGL1	Y			4	X			4	X										
APIACEAE																				
Lomatium orientale Coult. & Rose	LOOR1	Y	20	0.11	16	0.06	28	0.02	8	0.16	8	X	8	0.03						
ASCLEPIADACEAE																				
Asclepias pumila (Gray) Vail	ASPU1	Y							4	X										
ASTERACEAE																				
Achillea millefolium L. ssp. lanulosa (Nutt.) Piper	ACMI1	Y	4	0.10							4	X	4	0.29						
Ambrosia psilostachya DC.	AMPS1	Y	4	0.03	4	0.03	12	1.22												
Antennaria microphylla Rydb.	ANMI1	Y	4	0.03			4	0.05												
Artemisia dracunculus L.	ARDR1	Y									8	1.34								
Artemisia frigida Willd.	ARFR1	Y	20	1.07	4	0.30	8	0.74	16	3.67			4	4.94						
Artemisia ludoviciana Nutt.	ARLU1	Y	12	0.38	4	0.08			12	0.98	4	0.61	52	10.51						
Aster ericoides L.	ASER1	Y			4	0.03			20	0.74	28	3.28	4	0.11						
Aster porteri Gray	ASPO1	Y	84	12.78			16	0.94	12	1.47										
Carduus nutans L.	CANU1	N			8	2.88			4	0.64	24	0.86	28	12.98						
Centaurea diffusa Lam.	CEDI1	N							4	4.69										
Chrysopsis villosa Pursh.	CHVI1	Y	92	11.12	4	X	28	2.96	20	3.15	4	0.05			8	0.45				
Cirsium arvense (L.) Scop.	CIAR1	N											4	0.40	20	0.43	8	0.14	4	1.20
Cirsium undulatum (Nutt.) Spreng.	CIUN1	Y			4	1.49			4	1.07	4	0.24	4	0.40						
Erigeron divergens T. & G.	ERDI1	Y			4	0.16					8	X								
Erigeron flagellaris A. Gray	ERFL1	Y					8	0.21	12	0.40	4	0.05	8	3.41						
Gaillardia aristata Pursh.	GAAR1	Y	8	0.16			8	0.19												
Grindelia squarrosa (Pursh.) Dun.	GRSQ1	Y							4	0.06	24	1.78	12	7.86			4	0.02		
Gutierrezia sarothrae (Pursh.) Britt. & Rusby	GUSA1	Y									8	1.92	4	0.30	12	0.05	4			
Helianthus pumilus Nutt.	HEPU1	Y							4	0.02								0.02		
Kuhnia eupatorioides L.	KUEU1	Y							4	2.05			4	0.14	4	0.05				
Lactuca serriola L.	LASE1	N					4	0.02	4	0.02	8	0.16	8	0.18						
Liatris punctata Hook.	LIPU1	Y	80	8.43			60	14.54					4	0.46						
Ratibida columnifera (Nutt.) Woot. & Standl.	RACO1	Y	4	0.06					28	0.93	4	0.06	4	X						
Scorzonera laciniata L.	SCLA1	N			12	0.27			64	5.97	64	4.69								
Senecio plattensis Nutt.	SEPL1	Y	8	0.06					4	X			4	0.02						
Solidago missouriensis Nutt.	SOMI1	Y	4	0.08																

TABLE 17. (cont.)

SCIENTIFIC NAME	SPECCODE	NATIVE	XERIC GRASSLAND TR01-94 FREQUENCY	XERIC GRASSLAND TR01-94 BIOMASS ACSYP	TR06-94 FREQUENCY	TR06-94 BIOMASS ACSYP	TR12-94 FREQUENCY	TR12-94 BIOMASS ACSYP	MESIC GRASSLAND TR02-94 FREQUENCY	MESIC GRASSLAND TR02-94 BIOMASS ACSYP	TR04-94 FREQUENCY	TR04-94 BIOMASS ACSYP	TR11-94 FREQUENCY	TR11-94 BIOMASS ACSYP	RECLAIMED GRASSLAND TR07-94 FREQUENCY	RECLAIMED GRASSLAND TR07-94 BIOMASS ACSYP	TR08-94 FREQUENCY	TR08-94 BIOMASS ACSYP	TR09-94 FREQUENCY	TR09-94 BIOMASS ACSYP
Thelesperma megapotanicum (Spreng.) O. Ktze.	THME1	Y			4	0.48														
Townsendia hookeri Beaman	TOHO1	Y	4	X																
Tragopogon dubius Scop.	TRDU1	N	16	0.14	4	X	56	0.85	44	0.46	48	1.71	36	0.82	8	0.16			4	0.11
BORAGINACEAE																				
Lappula redowskii (Hornem.) Greene	LARE1	Y							4	X	4	0.05	8	0.06						
Lithospermum incisum Lehm.	LIIN1	Y							4	X										
BRASSICACEAE																				
Alyssum minus (L.) Rothmaler	ALMI1	N	24	0.86	8	9.84	72	8.67	32	3.78	16	2.46	16	2.05	56	2.91	28	0.93	44	1.02
Arabis sp.	ARA1								4	X										
Brassicaceae sp.	BR1				16	0.02							8	0.05						
Camelina microcarpa Andrz. ex DC.	CAMI1	N	8	0.02	36	2.14	64	1.14	4	0.05	36	0.77	40	0.75	16	0.08	4	X	4	0.06
Descurainia pinnata (Walt.) Britt.	DEPI1	Y					8	0.06	20	0.16	32	0.58	28	0.42						
Descurainia richardsonii (Sweet) Schultz	DERI1	Y											4	0.05						
Descurainia sp.	DES1										4	X								
Draba reptans (Lam.) Fern.	DRRE1	Y	12	0.08	4	X	12	0.05	8	0.03	8	0.08	4	X						
Erysimum asperum (Nutt.) DC.	ERAS1	Y			8	0.22														
Erysimum repandum L.	ERRE1	N									4	X								
Lepidium densiflorum Schrad.	LEDE1	Y									4	X								
Lepidium sp.	LEP1						8	0.21			12	0.05								
Lesquerella montana (A. Gray) Wats.	LEMO1	Y	76	0.86	32	0.19	4	0.10	8	0.06			4	X						
Sisymbrium altissimum L.	SIAL1	N			12	3.63	8	0.80	4	0.05	12	0.16	8	X						
Thlaspi arvense L.	THAR1	N									4	0.13								
CACTACEAE																				
Coryphantha missouriensis (Sweet) Britt. & Rose	COMI1	Y							4	X	4	X	4	X						
Echinocereus viridiflorus Engelm.	ECVI1	Y	40	X	4	X	48	X					16	X						
Opuntia humifusa (Raf.) Raf.	OPHU1	Y	24	X	8	X	20	X	12	X	16	X	4	X					4	X
CARYOPHYLLACEAE																				
Arenaria fendleri A. Gray	ARFE2	Y	80	7.94			56	3.14												
Paronychia jamesii T. & G.	PAJA1	Y	32	1.15																
Silene drummondii Hook.	SIDR1	Y	4	0.05																
CHENOPODIACEAE																				
Chenopodium leptophyllum Nutt. ex Moq.	CHLE2	Y			4	X			16	0.08	4	0.03								
CLUSIACEAE																				
Hypericum perforatum L.	HYPE1	N	28	0.16	4	0.02	8	0.29			4	0.02	4	X						

TABLE 17. (cont.)

			XERIC GRASSLAND						MESIC GRASSLAND						RECLAIMED GRASSLAND					
			TR01-94		TR06-94		TR12-94		TR02-94		TR04-94		TR11-94		TR07-94		TR08-94		TR09-94	
SCIENTIFIC NAME	SPECCODE	NATIVE	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP
COMMELINACEAE																				
Tradescantia occidentalis (Britt.) Smyth	TROC1	Y									12	0.08								
CONVOLVULACEAE																				
Convolvulus arvensis L.	COAR1	N													12	0.02	8	0.06	56	4.00
Evolvulus nuttallianus R. & S.	EVNU1	Y							8	0.16										
CYPERACEAE																				
Carex eleocharis Bailey	CAEL1	Y									16	8.61								
Carex heliophila Mack.	CAHE1	Y	80	4.34	40	3.12	96	5.30	16	0.99			68	13.26						
EUPHORBIACEAE																				
Euphorbia spathulata Lam.	EUSP1	Y							4	X	8	0.02								
FABACEAE																				
Dalea purpurea Vent	DAPU1	Y	8	0.35					4	0.22										
Medicago lupulina L.	MELU1	N													52	0.32	48	0.96		
Melilotus alba Medic.	MEAL1	N															8	0.11		
Melilotus officinalis (L.) Pall.	MEOF1	N													20	1.47	24	0.06		
Oxytropis lambertii Pursh.	OXLA1	Y	8	0.14			8	0.16												
Psoralea tenuiflora Pursh.	PSTE1	Y	32	2.16			40	3.30	12	0.32	20	1.55	16	1.47						
Trifolium sp.	TRI1												4	X						
Vicia americana Muhl. ex Willd.	VIAM1	Y							8	0.03	16	0.45	16	0.18			28	0.21		
GERANIACEAE																				
Erodium cicutarium (L.) L'Her.	ERCI1	N							4	0.02										
HYDROPHYLLACEAE																				
Phacelia heterophylla Pursh.	PHHE1	Y	4	0.42									4	0.78						
LILIACEAE																				
Allium textile A. Nels. & Macbr.	ALTE1	Y			4	0.02							4	X						
LINACEAE																				
Linum perenne L. var. lewisii (Pursh.) Eat. & Wright	LIPE1	Y			28	2.19			24	0.50	8	0.03								
MALVACEAE																				
Sphaeralcea coccinea (Pursh.) Rydb.	SPCO1	Y					4	0.14	32	0.94	32	0.66								
NYCTAGINACEAE																				
Mirabilis linearis (Pursh.) Heimerl	MILI1	Y	12	0.13			8	0.03	8	0.05	16	0.27								
ONAGRACEAE																				
Gaura coccinea Pursh.	GACO1	Y			4	0.02			4	0.03	16	0.10								
OROBANCHACEAE																				

TABLE 17. (cont.)

SCIENTIFIC NAME	SPEC CODE	NATIVE	XERIC GRASSLAND TR01-94 FREQUENCY	XERIC GRASSLAND TR01-94 BIOMASS ACSY SP	TR06-94 FREQUENCY	TR06-94 BIOMASS ACSY SP	TR12-94 FREQUENCY	TR12-94 BIOMASS ACSY SP	MESIC GRASSLAND TR02-94 FREQUENCY	TR02-94 BIOMASS ACSY SP	TR04-94 FREQUENCY	TR04-94 BIOMASS ACSY SP	TR11-94 FREQUENCY	TR11-94 BIOMASS ACSY SP	RECLAIMED GRASSLAND TR07-94 FREQUENCY	TR07-94 BIOMASS ACSY SP	TR08-94 FREQUENCY	TR08-94 BIOMASS ACSY SP	TR09-94 FREQUENCY	TR09-94 BIOMASS ACSY SP
Orobanche fasciculata Nutt.	ORFA1	Y					8	X					8	X						
PLANTAGINACE																				
Plantago patagonica Jacq.	PLPA1	Y			4	0.02					12	0.03								
POACEAE																				
Agropyron cristatum (L.) Gaertn.	AGCR1	N																	4	0.29
Agropyron intermedium (Host) Beauv.	AGIN1	N													88	51.20	100	16.86	100	96.37
Agropyron smithii Rydb.	AGSM1	Y			16	3.39			96	34.19	100	22.45	88	22.24						
Andropogon gerardii Vitman	ANGE1	Y	40	11.82	8	1.97	28	5.20	8	1.60			28	9.44						
Andropogon scoparius Michx.	ANSC1	Y	32	5.94	4	1.86	24	4.59												
Aristida purpurea Nutt. var. longiseta (Steud.) Vasey	ARFE1	Y			12	0.38	4	0.06	4	0.18			8	0.94						
Aristida purpurea Nutt. var. robusta (Merrill) A. Holm. & N. Holm	ARLO1	Y			4	0.05			12	0.40			4	0.06			4	0.18		
Aristida sp.	ARI1				4	0.05														
Bouteloua curtipendula (Michx.) Torr.	BOCU1	Y	64	2.62	24	1.84	68	4.88	28	4.56	4	0.50	24	1.02						
Bouteloua gracilis (H. B. K.) Lag ex Griffiths	BOGR1	Y	52	0.93	76	3.54	68	1.36	60	6.66	76	6.94	52	2.53						
Bouteloua hirsuta Lag	BOHI1	Y	88	1.82	40	0.56	48	0.88	36	4.00	8	1.25	28	0.88						
Bromus inermis Leyss. ssp. inermis	BRIN1	N													80	81.81	100	100.51	80	74.62
Bromus japonicus Thunb. ex Murr.	BRJA1	N	8	0.05	36	2.35	20	0.16	84	10.06	100	34.37	92	14.61	4	0.03	4	X	12	0.03
Bromus tectorum L.	BRTE1	N					8	0.37			36	2.11	40	5.07						
Buchloe dactyloides (Nutt.) Engelm.	BUDA1	Y	16	0.43	4	0.02			32	1.22	20	0.77	8	0.13						
Koeleria pyramidata (Lam.) Beauv.	KOPY1	Y	80	2.62	12	0.24	32	1.22	12	X	4	0.27								
Muhlenbergia montana (Nutt.) Hitchc.	MUMO1	Y	40	5.46																
Muhlenbergia wrightii Vasey	MUWR1	Y							4	1.71										
Poa compressa L.	POCO1	N	16	4.03	32	10.86	16	3.62			16	4.42	8	5.31						
Poa pratensis L.	POPR1	N	28	3.92	16	1.54	20	1.04	4	0.88	20	2.59	32	4.67	4	0.48				
Sitanion hystrix (Nutt.) Sm. var. brevifolium (Sm.) Hitchc.	SIHY1	Y	8	0.38	4	0.02	4	0.03	4	0.05										
Sorghastrum nutans (L.) Nash	SONU1	Y	8	0.03			12	1.39												
Stipa comata Trin. & Rupr.	STCO1	Y	60	6.93	92	47.10	100	55.71	8	0.82			52	11.23						
Stipa neomexicana (Thur.) Scribn.	STNE1	Y			12	3.25														
Stipa viridula Trin.	STVI1	Y							8	0.96	16	0.40	60	2.50						
POLYGONACEAE																				
Eriogonum alatum Torr.	ERAL1	Y	48	2.18																
PORTULACACEAE																				
Talinum parviflorum Nutt.	TAPA1	Y	8	X																
ROSACEAE																				

TABLE 17. (cont.)

			XERIC GRASSLAND						MESIC GRASSLAND						RECLAIMED GRASSLAND					
			TR01-94		TR06-94		TR12-94		TR02-94		TR04-94		TR11-94		TR07-94		TR08-94		TR09-94	
SCIENTIFIC NAME	SPECCODE	NATIVE	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP	FREQUENCY	BIOMASS CYP
Rosa arkansana Porter	ROAR1	Y							8	X	8	X	4	X						
SANTALACEAE																				
Comandra umbellata (L.) Nutt.	COUM1	Y	4	0.03																
SCROPHULARIACEAE																				
Castilleja sessiliflora Pursh.	CASE3	Y	4	0.03																
Linaria dalmatica (L.) Mill.	LIDA1	N			92	51.47					20	4.26	20	2.69			4	0.06		
Penstemon virens Penn.	PEVI1	Y											4	0.82						
Total Current Year Production (g/m^2)				102.5		157.7		125.6		101.1		113.2		146.1		139.5		120.1		177.7
Percent Native Current Year Production (by site)				91		46		86		74		48		66		0.39		0.35		0
Percent Native Current Year Production (by community)						74						63						0.25		

Frequency = proportion of the total number of plots that encountered a given species (n=25)
Biomass CYP = biomass current year production (g/m^2)
x = trace amount (< 0.01 g/m^2)

TABLE 18. 1996 VEGETATION TYPES MAP SUMMARY INFORMATION

Habitat Type	Habitat Code	Total Area (ft²)	Total Acres	Percent of Site
Grasslands				76.6
Mesic Mixed Grassland	322	96382881.3	2212.6	34.1
Xeric Tallgrass Prairie	331	78873781.2	1810.7	27.9
Reclaimed Mixed Grassland	324	28110654.4	645.3	10.0
Xeric Needle and Thread Grass Prairie	332	8211554.1	188.5	2.9
Annual Grass/Forb Community	410	4269738.9	98.0	1.5
Short Grassland	310	433106.6	9.9	0.2
Wetlands				6.3
Wet Meadow/Marsh Ecotone	010	11065436.8	254.0	3.9
Short Marsh	020	5310091.4	121.9	1.9
Tall Marsh	030	1368792.0	31.4	0.5
Woodlands/Shrublands				2.8
Short Upland Shrubland	220	1718940.6	39.5	0.6
Tall Upland Shrubland	230	1481518.6	34.0	0.5
Savannah Shrubland	260	1343294.0	30.8	0.5
Riparian Woodland	110	1216451.5	27.9	0.4
Leadplant Riparian Shrubland	211	1143626.5	26.3	0.4
Willow Riparian Shrubland	212	627962.7	14.4	0.2
Ponderosa Woodland	120	514838.5	11.8	0.2
Other				14.3
Disturbed and Developed Areas	420	37837811.9	868.6	13.4
Open Water	0	1760988.7	40.4	0.6
Mudflats	090	467576.9	10.7	0.2
Riprap, Rock, and Gravel Piles	530	323161.2	7.4	0.1
Tree Plantings	130	24149.7	0.6	0.0
TOTAL ACREAGE			6485.0	

TABLE 19. SUCCESSIONAL STAGES ON THE EASTERN PLAINS OF COLORADO

Judd (1974)	Shantz (1917)	Costello (1944)
Annual weed stage (1-5 years)	Early weed stage (1-3 years)	Initial stage (2-5 years)
Mixed annual-perennial stage (3-7 years)	Late weed stage (2-5 years)	Forb stage (3-6 years)
Perennial stage (5-12 years)	Short-lived grass stage (4-8 years)	Short-lived perennial stage (4-10 years)
Perennial climax grasses (10-50 years)	Perennial stage (7-14 years)	Aristida stage (10-20 years)
	Early short-grass stage (13-25 years)	Climax mixed prairie (20-50 years)
	Late short-grass stage (20-50 years)	

Appendix A

Vegetation Map: Background and Habitat Codes

VEGETATION MAP BACKGROUND

During the winter of 1996, work was begun on updating the Site vegetation types map (Figure 2 in the main body of the report) to make it more useful. The most important reason for the update was that maps produced previously either were no longer current or were not accurate enough for managing Site ecological resources.

- An early vegetation map produced by Clark (1980) showed the vegetation as of 1974. Although it provides a good historical perspective on Site vegetation, the map no longer accurately represents the Site vegetation because of changes over the past two decades resulting from disturbances, stream channel and flow alterations, and the elimination of grazing.
- In 1991, as part of the baseline ecological characterization at the Site (DOE 1992), an updated vegetation map was produced. It more accurately represented the vegetation at the Site, but numerous errors were present as a result of incomplete ground truthing and the lack of an accurate base map.
- In 1994–95, an attempt was made to use multi-spectral imagery to produce a vegetation map of the Site. Unfortunately, the map was not as accurate as previous maps and was of little value for ecological work at the Site.

As a result, the Ecology group, working in coordination with the Site GIS group, began work on creating an updated vegetation map.

METHODS

A classification system (Appendix B) was developed based on the classification units delineated on the older maps, interpretation of new vegetation monitoring information, and the classifications (habitat-type categories) used for much of the other ecological monitoring at the Site. A general wildlife habitat-type classification system was selected, because it had been used on past maps and in past databases. Also, the lack of detailed plant association data for the Site made a plant association map impractical, given the time limitations for producing it.

Mapping was done primarily on the ground. The entire Site was traversed on foot, field checked, and mapped in the field, by drawing map units on acetate-covered aerial photographs (color, infra-red, and black and white) or blank maps of the Site. The minimum size of mapping units varied depending on community type. Greater mapping detail was achieved along riparian corridors than was possible in the grasslands. In the grassland units, minimum mapping unit sizes were generally larger than those found in riparian areas, because of the difficulty in determining actual position on the ground and problems associated with seeing small community transitions on the aerial photos. In the riparian woodlands, shrublands, and some wetland areas, where structural differences in vegetation were more easily visible in the photographs, more detailed mapping of smaller unit sizes was possible. Aerial photographs used in the field were at a scale of 1:4,000. Data delineated in the field were then transferred to acetate overlays on large, rectified black-and-white orthophotos (1:6,000), which were available in digital format in the Site geographic information system (GIS). The delineated map units drawn on the acetate over the larger photographs were digitized into the Site GIS, and digitized results were proofed, cleaned up, and labeled with the classification units. Draft maps were produced and checked for accuracy before the final vegetation map was produced.

VEGETATION MAP RESULTS AND DISCUSSION

The final updated 1996 vegetation types map is shown in Figure 2 (larger maps are available from the Site GIS group). The total area covered by each classification type on the map was calculated from the GIS (see report, Table 18). The grassland communities accounted for nearly 77 percent of the vegetation cover. Wetland areas provided approximately 6 percent, and woodlands/shrublands approximately 3 percent, of the cover. Other classifications, including disturbed and developed areas, open water, mudflats, riprap, and rock piles, accounted for about 14 percent. The disturbed and developed areas included the Industrial Area (which was blocked out as a whole), mining operations, landfills, and the Site road system.

The new Site vegetation map provides important information for addressing ecological resource management and environmental cleanup at the Site. Potential uses for the map include, but are not limited to, the following:

- Land use planning
- National Environmental Protection Act (NEPA) compliance
- Natural Resource Damage Assessment (NRDA)
- Resource Conservation and Recovery Act (RCRA) issues
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) compliance
- Natural resource trustee and other cleanup issues

- Wildlife management concerns (including the Preble's meadow jumping mouse)
- Tracking changes in plant communities
- Identifying and protecting sensitive wildlife habitats and rare plant communities
- Tracking weed control and controlled burn effects
- Showing the effects of habitat fragmentation
- Providing information on wildlife corridor issues.

1996 VEGETATION MAP HABITAT CODES

000 AQUATIC AND WETLANDS HABITATS GROUP

Terrestrial Subgroup

010 Wet Meadow/Marsh Ecotone

Typified by the presence of *Agrostis stolonifera*, *Spartina pectinata*, or occasionally solid stands of *Poa compressa* or *Agropyron smithii*. Other common plants found in this classification type include *Asclepias speciosa*, *Iris missouriensis*, *Cirsium arvense*, *Rumex* sp., and sometimes *Arnica fulgens*. Soils are usually fine, silty materials with few rocks. These areas are commonly found on the edges of the streams, ponds, seeps, and other wetter areas at the Site, often just beyond the short marsh and tall marsh classifications.

020 Short Marsh

Typified by stands of *Carex* sp. and/or *Juncus* sp. This classification is usually wet and underwater for parts of the year. It has fine, muddy soils with few rocks.

030 Tall Marsh

Typified by stands of *Typha* sp. and/or *Scirpus* sp. These areas are usually under water and have generally fine, muddy soils with few rocks.

Open Water Subgroup

050 Ponds and Impoundments

054 Open Water

This classification was used for the ponds and other open water bodies at the Site.

Emergent Subgroup

090 Mudflats

This classification represents areas that often become exposed between the high and low water marks along the pond margins. It also includes small pool areas that completely dry out during the summer. Vegetation is usually sparse, but may include such species as *Echinochloa crusgallii*, *Rumex* sp., *Polygonum* sp., or a few other grasses or sedges.

100 WOODLANDS HABITAT GROUP

110 Riparian Woodland

This classification is typified by stands of *Populus deltoides*, *Salix amygdaloides*, *Ulmus pumila*, *Populus albus*, and perhaps a few other tree species. There may also be an understory of *Prunus* sp., *Symphoricarpos* sp., *Salix* sp., or other woody species. This classification is found primarily along the drainage bottoms at the Site.

120 Ponderosa Woodland
Typified by scattered stands of *Pinus ponderosa* with some occasional *Pseudotsuga menziesii*. This classification is found primarily on the western edge of the Site on the northern edges of ridgetops. It is also common along the old railroad grade. It is often surrounded by xeric mixed grassland.

130 Tree Plantings
This classification represents areas where trees have been planted for landscaping or shelterbelt purposes. The only occurrence of this classification in the Buffer Zone is the apple orchard. Areas of this classification are present in the Industrial Area, but no vegetation mapping was done there for this map.

200 SHRUBLANDS HABITATS GROUP

210 Riparian Shrubland
This classification is composed of stands of *Salix exigua* and/or *Amorpha fruticosa*. It is found primarily along the stream channels at the Site. This classification was broken down into two other subdivisions, depending on which species was dominant.

- **211 Riparian Shrubland** - Stands dominated by *Amorpha fruticosa*.
- **212 Riparian Shrubland** - Stands dominated by *Salix exigua*.

220 Short Upland Shrubland
This classification is dominated by stands of *Symphoricarpos occidentalis* and occasionally *Rosa* sp. This classification is typically found in a wetter environment than the Savannah Shrubland habitat described below. The short upland shrub is often found in association with wet meadows and other aquatic/riparian/wetland classifications.

230 Tall Upland Shrubland
This classification is typified by stands of *Crataegus erythropoda*, *Prunus virginiana*, and *Prunus americana*. Most of this classification is found on north-facing slopes in the Rock Creek drainage. It is typically underlain by cobbly, gravely soils.

260 Savannah Shrubland
This classification represents areas of open shrubland with grassland between the scattered shrubs. The predominant shrub for this classification is *Rhus aromatica*, but occasionally *Ribes* ssp. and some other woody species may be present. Most of this classification is found in the Rock Creek drainage at the Site.

300 GRASSLANDS HABITATS GROUP

310 Short Grassland

This classification is typified by stands of short grass prairie species, *Buchloe dactyloides* and *Bouteloua gracilis*. Very little of this classification is found at the Site.

320 Mixed Grassland

This classification is broken down into three subdivisions found at the Site, which often intermix, making boundary deliniations difficult between the classification types.

322 Mesic Mixed Grassland

This classification is dominated by *Agropyron smithii*, *Poa pratensis*, and *Bouteloua gracilis*. Other common species include *Stipa viridula*, *Poa compressa*, *Bromus japonicus*, and *Alyssum minus*. In contrast with the bunchgrass appearance of the xeric mixed grassland described below, these grasslands have more of a solid turf appearance as a result of the physiognomy of the species present. The soils are considered to be clay loams and do not have the cobbly appearance at the surface that is typical of the xeric mixed grassland soils. Most of the hillsides on the Site are considered mesic mixed grassland, and their quality varies considerably. The mesic mixed grasslands on the western side of the Site seem to have been less degraded by exotic, non-native invaders such as *Bromus japonicus*, *Alyssum minus*, and *Carduus nutans*, than those on the eastern edge. For classification purposes, no distinctions were made based on the impact of these exotic species. As long as an understory of *Agropyron smithii, Poa pratensis*, or *Bouteloua gracilis* was present beneath the exotic, non-native species, the grassland was still classified as mesic mixed grassland.

323 Xeric Mixed Grassland

This classification is dominated by *Andropogon gerardii*, *Andropogon scoparius*, *Stipa comata*, *Muhlenbergia montana*, *Carex heliophila*, *Arenaria fendleri*, *Aster porteri*, *Koleria pyrimidata*, and *Liatris punctata*. The grassland has a bunchgrass appearance as a result of the physiognomy of the species present. Stands of *Yucca glauca*, which are found in a few spots primarily on ridgetops on the eastern side of the Site, are also included in the xeric mixed grassland classification, because they are often surrounded and intermixed with this classification type. This classification is found on nearly all the pediments and ridgetops at the Site and is underlain by Rocky Flats Alluvium. The soils are considered to be sandy clay loams with lots of cobbles. The surface of the ground is usually very rocky. Two subdivisions of xeric mixed grassland were recognized:

331 Xeric Tallgrass Prairie

This subdivision is dominated by *Andropogon gerardii* and *Andropogon scoparius*. It also contains high cover of *Muhlenbergia montana*, *Carex heliophila*, *Arenaria fendleri*, and *Aster porteri*. Other tallgrass prairie species include *Sorghastrum nutans, Sporobolus heterolepis*, and *Panicum virgatum*. The soils are usually visibly cobbly on the surface.

332 Xeric Needle and Thread Grass Prairie

This subdivision is dominated by *Stipa comata and Stipa neomexicana*. It contains very little *Andropogon gerardii* and *Andropogon scoparius*. The soils are not quite as visibly cobbly as the xeric tallgrass prairie.

324 Reclaimed Mixed Grassland

This classification is dominated by *Bromus inermis, Agropyron intermedium, Agropyron cristatum, Melilotus* sp., *Convolvulus arvensis*, and other planted or adventive species. This classification covers all Site areas that have previously been farmed or disturbed, and then revegetated with various seed mixtures. Large tracts of this habitat type are found in the southeastern portion of the Site and in and around the Industrial Area.

400 DISTURBANCE HABITAT GROUP

410 Annual Grass/Forb

This classification is dominated by a plant community of annuals such as *Bromus japonicus, Bromus tectorum, Centaurea diffusa, Helianthus annus*, and other associated species. This category was used when little or no mesic mixed grassland community existed beneath the annual species listed above. These areas were often disturbed, unrevegetated areas or areas where reclamation efforts had failed and an annual, early successional stage had established.

420 Disturbed /Barren Lands (Roads)

This classification was used for the roads and Industrial Area and other disturbed barren areas.

500 STRUCTURES AND STRUCTURE ASSOCIATIONS HABITATS GROUP

530 Rock and Gravel Piles

This classification was used for rip/rap piles along stream channels and on dam faces.

Appendix B

EcMP 1993–95 Data Sets

EcMP 1993–95 DATA SETS

The following list provides information for analyzing and interpreting the 1993–95 EcMP terrestrial vegetation data sets. The filenames and associated concerns are addressed.

GENERAL COMMENTS CONCERNING THE DATA SETS

The phenological-state data contained in all the belt transect data sets must be used with caution. The method in which it was gathered did not take into account abundance associated with each phenological state; also, not all the states recorded for each species are contained in the electronic data sets.

1993 DATA SETS

1993 EcMP terrestrial vegetation sampling was conducted by a subcontractor to EG&G. Technical problems were encountered with the data sets largely as a result of sampling errors attributable to the field personnel's lack of familiarity with the Site flora. All vegetation sampling was conducted in mid- to late summer. Correct field identification of many species was a constant problem and must be considered when interpreting the data sets.

belt931.dbf — Contains the "spring 1993" belt transect data. The term "spring" is a misnomer, however, because sampling was conducted in July. Therefore, this data set does not include the spring ephemerals from the sites.

belt932.dbf — Contains the late summer 1993 belt transect data. The woody stem density data include a number of subshrub species such as *Gutierrizia sarothrae*, *Artemesia frigida*, *Artemesia dracunculus*, and others that were not included in counts during the 1995 sampling, so this must be taken into consideration when analyzing the data to obtain comparable numbers.

pit932.dbf — Contains the late summer 1993 point-intercept transect data. The basal cover portion of the data set is of no value and should not be used for any analyses because of serious inconsistencies and problems with the sampling. The foliar cover portion of the data set is usable, however.

quad932.dbf — Contains the late summer 1993 production plot sampling. The data were collected in such a manner as to only allow determination of total biomass for all species combined. Annual biomass of individual species cannot be determined from the data set, because current-year dead and previous-year dead materials were not separated by species.

pnut931.dbf Contains plant nutrient data from the first 1993 sampling session. No known problems with this data set.

pnut932.dbf Contains plant nutrient data from the second 1993 sampling session. No known problems with this data set.

1994 EcMP DATA SETS

1994 EcMP terrestrial vegetation sampling was conducted by EG&G (Site) staff ecologists. The late summer sampling session in 1994 lasted from August through the end of September, as a result of the large amount of sampling conducted. The length of time over which the data were collected could have some effect on the interpretation of certain results.

belt941.dbf Contains the spring 1994 belt transect data. No known problems.

belt942.dbf Contains the late summer 1994 belt transect data. The woody stem density data include a number of subshrub species such as *Gutierrizia sarothrae*, *Artemesia frigida*, *Artemesia dracunculus*, and others that were not included in counts during the 1995 sampling, so this must be taken into consideration when analyzing the data to obtain comparable numbers.

pit942.dbf Contains the late summer 1994 point-intercept transect data. No known problems.

quad942.dbf Contains the late summer 1994 production plot data. These data were collected such that species-specific biomass production can be determined.

1995 EcMP DATA SETS

1995 EcMP terrestrial vegetation sampling was conducted by RMRS (Site) staff ecologists. No production plot data were collected in 1995.

belt951.dbf Contains the 1995 spring belt transect data. As mentioned for the 1993 and 1994 point-intercept data sets, in 1995, a change was made concerning what woody species were counted.

belt952.dbf Contains the 1995 late summer belt transect data. No known problems.

pit952.dbf Contains the 1995 late summer point-intercept transect data. No known problems.

99/99